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ABSTRACT

An energy education program at the primary level should help students to understand the nature and importance of energy, consider different energy sources, learn about energy conservation, prepare for energy related careers, and become energy conscious in other career fields. The activities charts, readings, and experiments provided in this nine-section manual are designed to meet the objectives of such a program. The materials in the first five sections focus on: (1) the nature of energy; (2) uses of energy; (3) non-renewable energy and pollution; (4) energy conservation; and (5) solar energy. The next four sections provide experiments dealing with solar energy, insulation to conserve energy, wind to produce energy, and water to produce energy. Procedures and instructional strategies are provided when applicable. (JN)

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ENERGY ACTIVITIES

FOR THE PRIMARY CLASSROOM

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FOR: THE EL DORADO COUNTY ENERGY PROGRAM

EL DORADO COUNTY OFFICE OF EDUCATION

FUNDING FROM: California Energy Extension Service

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Objectives of an Energy Education Program
at the Primary Level

1. To enable students to understand what energy is.
2. To enable students to understand the importance of energy.
3. To prepare students to consider different energy sources.
4. To provide information about conservation.
5. To prepare students for energy related careers and to become energy conscious in other career fields.

"I have been teaching science programs for children for the past twelve years. During this time I have discovered or developed a number of effective energy activities for primary classes. This packet includes my outline for Energy Education at the primary level and sample activities, charts and readings. Those activities that were "discovered" are noted in the back under references."

My Primary Energy Program Outline

I. WHAT IS ENERGY?

Use the following activities to introduce the concept of energy:

- Energy Is . . .
- Finding Energy
- Be Energy
- Energy Transfer
- Hamburgers and Food Chains
- Energy Pyramid
- Poor Old Lady
- Untangle This Web
- Food Web Story
- Make a Local Food Web

II. HOW DO WE USE ENERGY?

Use the following activities:

- We Need Energy To . . .
- Electrical Appliances
- What If?

III. ENERGY PROBLEMS: NON-RENEWABLE AND POLLUTION

1. Most of the energy that we use comes from non-renewable sources. Use the following activity to help students understand the concept of non-renewable:

   - Trees' Energy
   - Presto, Chango . . .

2. Energy use can cause pollution. Use the following activities:

   - Catching Pollution
   - Car Exhaust
   - Every Person's Air

IV. CONSERVATION

1. YOU can help save valuable energy resources by using less energy. Use the following activity:

   - Class Conservation List

2. It takes a lot of energy to produce consumer goods. Use the following activity:

   - "Hidden" Energy Use

3. Each student can save energy and other resources by recycling and reusing materials. Choose from the following charts and activities:

- Recycling Glass
- Recycling Newspaper
- Decomposition
- Reuse That Jar
- Old Bag Art
- Recycled Paper
- Cloth Lunch Bags
- Classroom Waste
- Ways to Help Solve Solid Waste Problems
- The Reducing Game
- Junk Band Music
- Everywhere Is Somewhere
- How the Trash Pile Grows

V. ENERGY FROM THE SUN

The sun is an important source of energy. Choose from the following activities:

- Meet Mrs. Sun
- Make a Sun Mask
- Make a Sun Puppet
- Sun Jobs
- The Fable of Max

VI. EXPERIMENT WITH SOLAR ENERGY

Experiment with solar energy to better understand it's uses and potential. Pick and choose from the following activities:

- Plants as Solar Collectors
- Hot Cans
- Solar Food on a Clothesline
- Car Colors
- Sun Shadows
- Shadow Hunt
- Sun Tea
- Shadow Pictures
- X Marks the Spot
- How Much Hotter . . .*
- A Tin Can Solar Oven*
- Solar Hot Dog Cooker*
- Solar Air Heater*
- Solar Fruit Dryer*
- Solar Water Heater*
- Roof Ponds*

VII. EXPERIMENT WITH INSULATION TO CONSERVE ENERGY

Choose from the following activities to introduce the concept of insulation:

- "My, But You Have an Ice House"
- Natural Houses
- Ice Race
- The Heat Leak Detective Game

VIII. EXPERIMENT WITH WIND TO PRODUCE ENERGY

Primary students can start experimenting with wind to understand that the energy in wind causes movement. Choose from the following activities:

- Wind Detectives
- Simple Air Conditioners
- Wind Weather Vane
- Helix Magic
- Wind Poems
- Measuring the Wind
- Beaufort Wind Scale
- Draft Box

IX. EXPERIMENT WITH WATER TO PRODUCE ENERGY

Water contains energy that can cause movement. Choose from the following activities:

- Moving Water—Moving Blades*
- An Overshot Waterwheel*
- An Evaporative Cooler*
- A Power Plant from a Juice Can*

References

*These projects should be made by an adult or older students. The completed projects are valuable teaching tools for primary students.

I. WHAT IS ENERGY?

Energy is . . .

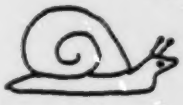
1. Energy is the ability to do work.
2. Energy causes movement. Every time you see something move, energy is being used. A leaf moving in the wind, a pot of water bubbling on the stove and a car traveling to the store are all evidence of energy being used.
3. You know that energy exists because you can see or feel what it does. Energy moves cars, makes machines run, heats ovens and lights our classroom.

Energy makes things move.

A moves.

A moves.

move.

A  moves.

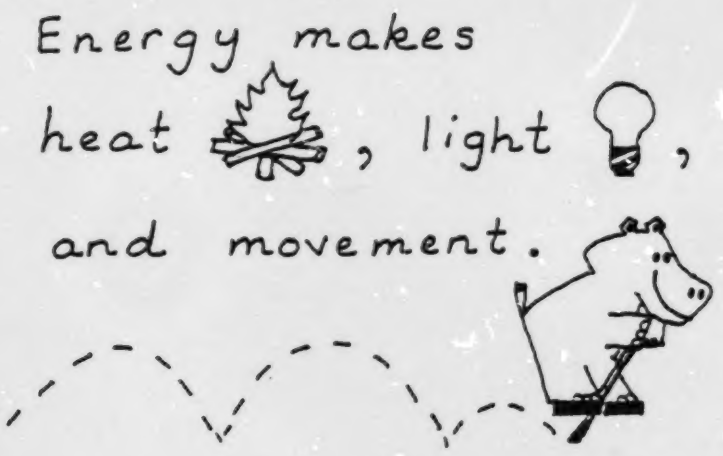
Finding Energy

You know energy exists when you notice motion, heat or light. Energy heats our classroom. Energy lights our classroom. Energy moves the bus that brings you to school.

Have students look for:

1. motion
2. heat
3. light

Make a list and/or book for each. Evidence of energy is everywhere!!!



Be Energy

1. Ask students, "What gives you energy?" They should answer, "food!"

2. Give each child a snack. While they eat the snack, explain that the snack is full of energy. By eating the snack, they get the snack's energy.

3. Have children use the snack energy to do jumping jocks, skip, hop, and run in place.

4. Stop. Ask students how they feel. They should tell you that they feel hot and tired. Explain that they are tired because they used up the snack energy. The snack energy turned into heat and has made them hot. Can they take the heat and turn it back into food? No!!! The food and food's energy are gone.

Energy Transfer

Read pages 36-50 of What Makes Everything Go? by Michael Elsohn Ross to the class. This reading explains energy transfer and loss.

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Hamburgers and Food Chains

1. Tell student, "I had a hamburger last night for dinner. What are hamburgers made from?" (cows) "so we eat cows. What do cows eat? "(grass)". Grass gets its food, or energy, from the sun.
2. Draw this food chain on the chalkboard or use a plannel board.
3. Discuss the transfer of the energy from the sun to the hamburger to you.
4. Have each student draw a personal food chain for something that they ate for breakfast.

Food Chains and Breakfast

sun—> grain (cereal)—> me

sun—> grain—> chicken (egg)—> me

sun—> grass—> cow—> milk—> me

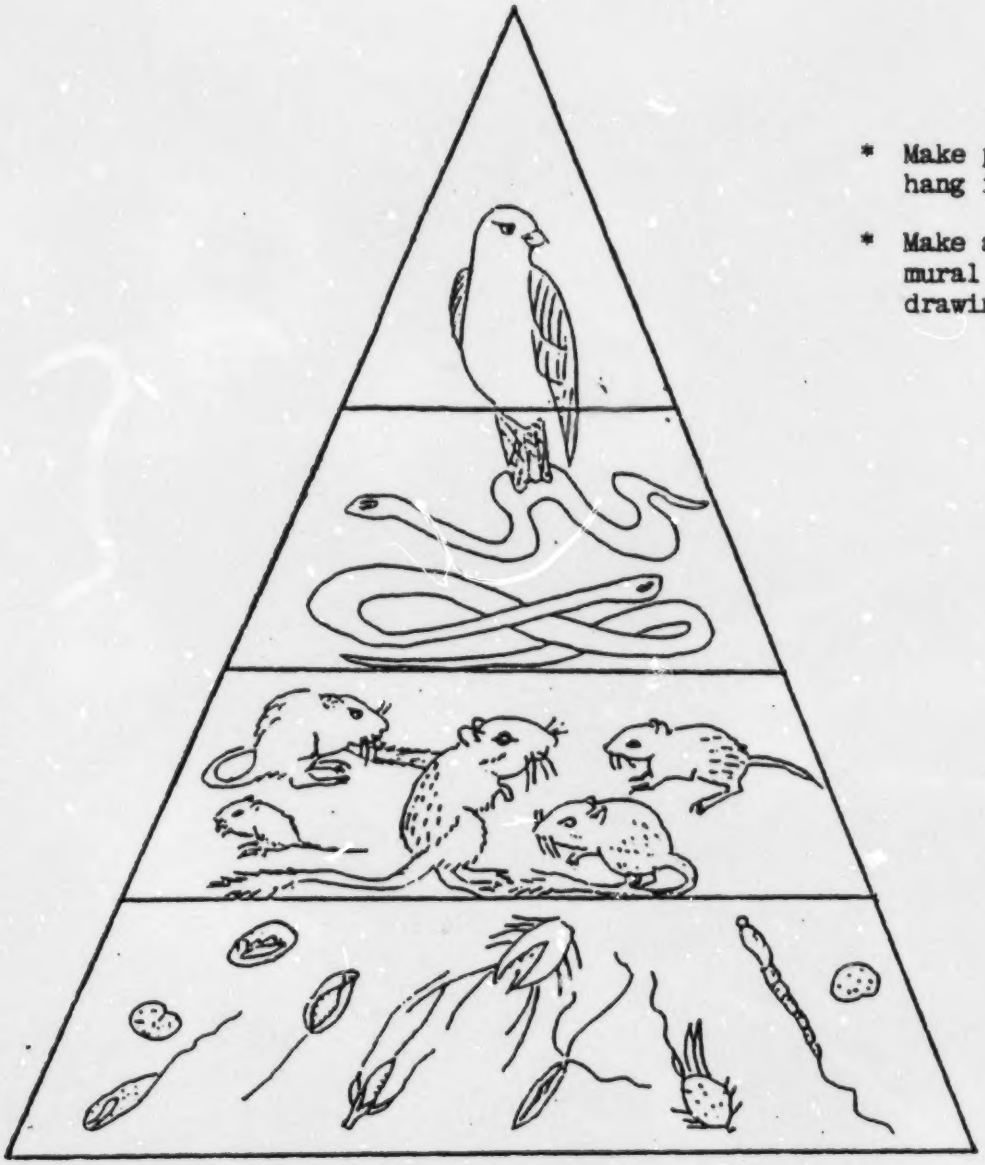
sun—> grain (bread)—> me

sun—> grass—> cow (milk—>butter)—> me

*Idea - Make food chains on large paper "Christmas tree chains". Hang chains from the ceiling.

Energy Pyramid

A food chain can be made in the shape of a pyramid to show that each time energy is transferred, some changes into heat and can no longer be used. A food chain is limited by the amount of energy available.



* Make pyramid mobiles to hang in the classroom.
* Make a large pyramid mural with students' drawings.

Poor Old Lady

My favorite food chain! Make a pocket chart picture for each step in the chain. Put up one picture at a time to cue students to chant the next step in the chain. These pictures can be mixed up and put in sequence by students.

Poor old lady, she swallowed a fly.
I don't know why she swallowed a fly.
Poor old lady, I think she'll die.

Poor old lady, she swallowed a spider.
It squirmed and wriggled and turned
inside her.
She swallowed the spider to catch the fly.
I don't know why she swallowed a fly.
Poor old lady, I think she'll die.

Poor old lady, she swallowed a bird.
How absurd! She swallowed a bird.
She swallowed the bird to catch the spider,
She swallowed the spider to catch the fly,
I don't know why she swallowed a fly,
Poor old lady, I think she'll die.

Poor old lady, she swallowed a cat.
Think of that! She swallowed a cat.
She swallowed the cat to catch the bird,
She swallowed the bird to catch the spider,
She swallowed the spider to catch the fly,
I don't know why she swallowed a fly,
Poor old lady, I think she'll die.

Poor old lady, she swallowed a dog.
She went the whole hog when she
swallowed the dog.
She swallowed the dog to catch the cat.
She swallowed the cat to catch the bird,
She swallowed the bird to catch the spider,
She swallowed the spider to catch the fly,
I don't know why she swallowed a fly.
Poor old lady, I think she'll die.

Poor old lady, she swallowed a cow.
I don't know how she swallowed the cow.
She swallowed the cow to catch the dog.
She swallowed the dog to catch the cat,
She swallowed the cat to catch the bird,
She swallowed the bird to catch the spider,
She swallowed the spider to catch the fly,
I don't know why she swallowed a fly.
Poor old lady, I think she'll die.
Poor old lady, she swallowed a horse.
She died, of course.

—Anonymous

Untangle This Web

Energy moves through food chains. Food chains connect together to make food webs. Do the following activity to demonstrate the complexity of energy transfer.

Assign twelve students to the following roles (Each student takes one role):

1) coyote	2) rabbit	3) ceanothus
4) chipmunk	5) pine nuts	6) black bear
7) grass	8) mouse	9) grasshopper
10) manzanita berries	11) weasel	12) small bird

As the following description of a food web is read, students take a ball of string when their role is named. They hold onto the string and pass the ball of string to the next person whose role is named, thus creating a "web" of string by the conclusion of the description.

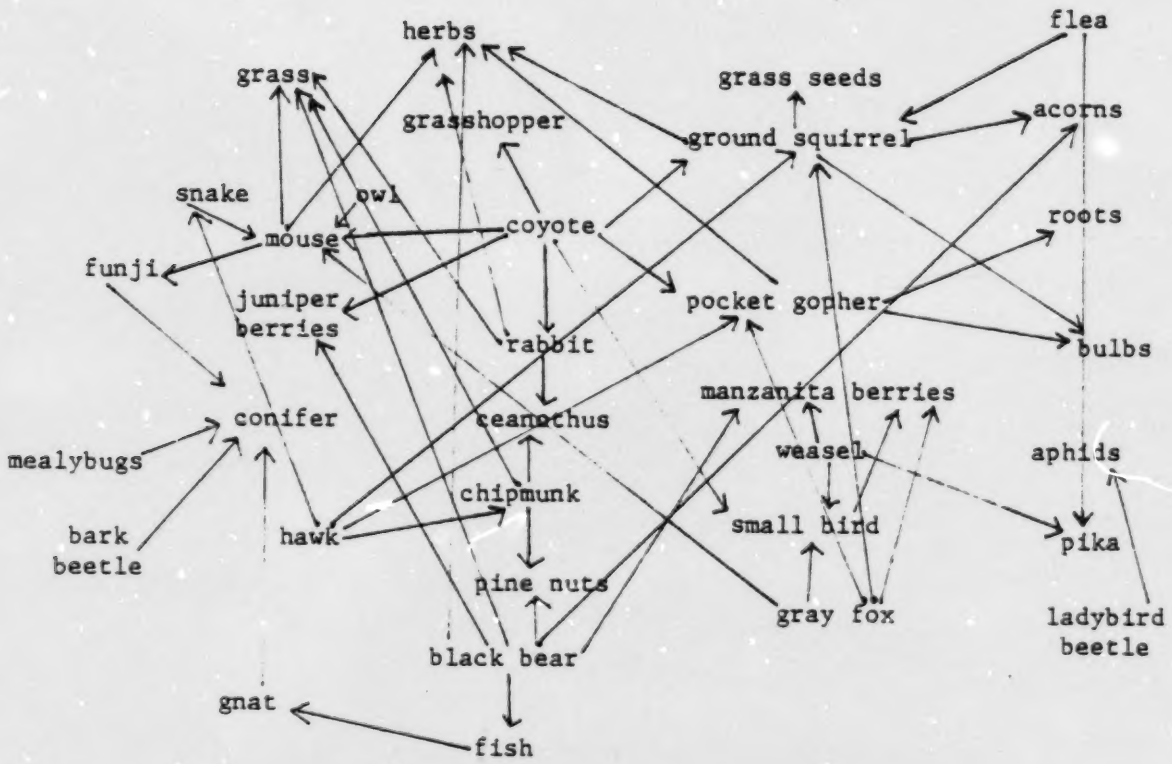
A Food Web Story

Coyotes eat rabbits. Rabbits eat ceanothus. Ceanothus is eaten by chipmunks. Chipmunks eat pine nuts. Pine nuts are also eaten by black bears. Black bears eat grass. Grass is also eaten by mice. Mice eat grasshoppers. Grasshoppers are also eaten by coyotes. Coyotes eat manzanita berries. Manzanita berries are also eaten by weasels. Weasels eat small birds. Small birds are also eaten by coyotes. I mentioned that coyotes eat rabbits. Rabbits eat grass. Grass, as I said, is also eaten by black bears. Black bears also eat manzanita berries.

Now that students are in a "web of string", the teacher cuts the string between two students. The cut string is then followed to see who is effected. The conclusion will be that when we effect one member of a food web, we effect all members of that web.

Make a Local Food Web

This food web was simple and fun to make. I looked up coyote in an encyclopedia. I found that coyotes eat ground squirrels, mice, grasshoppers, rabbits, juniper berriers and pocket gophers. I looked up each of these to find out what each eats and is eaten by. I just kept going!



II. HOW DO WE USE ENERGY?

We Need Energy To . . .

(Complete this list with your class)

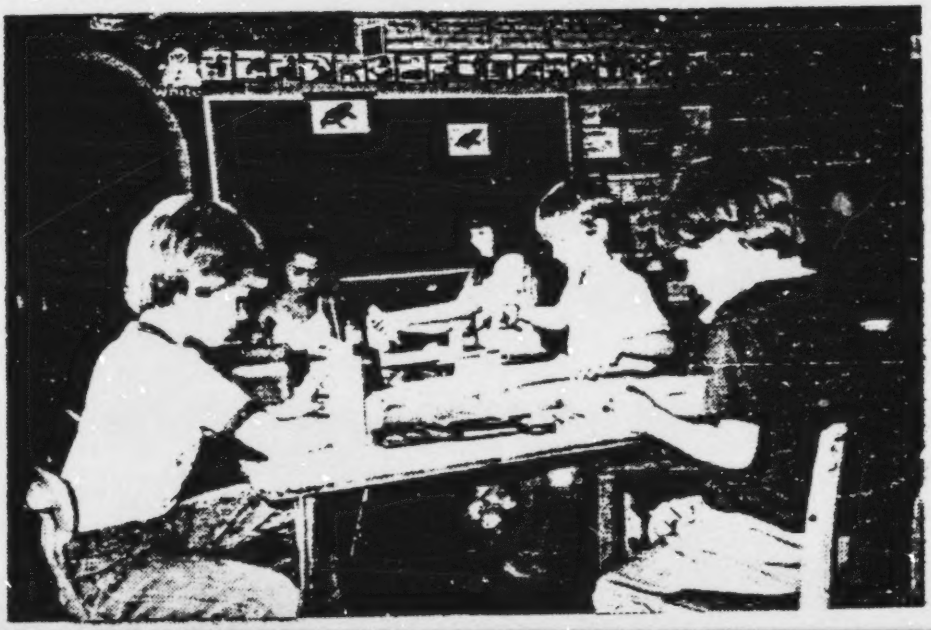
1. Play
2. Eat
3. Work
4. Drive
5. Heat or cool buildings
6. Make stereos, toasters, toys, etc.
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____

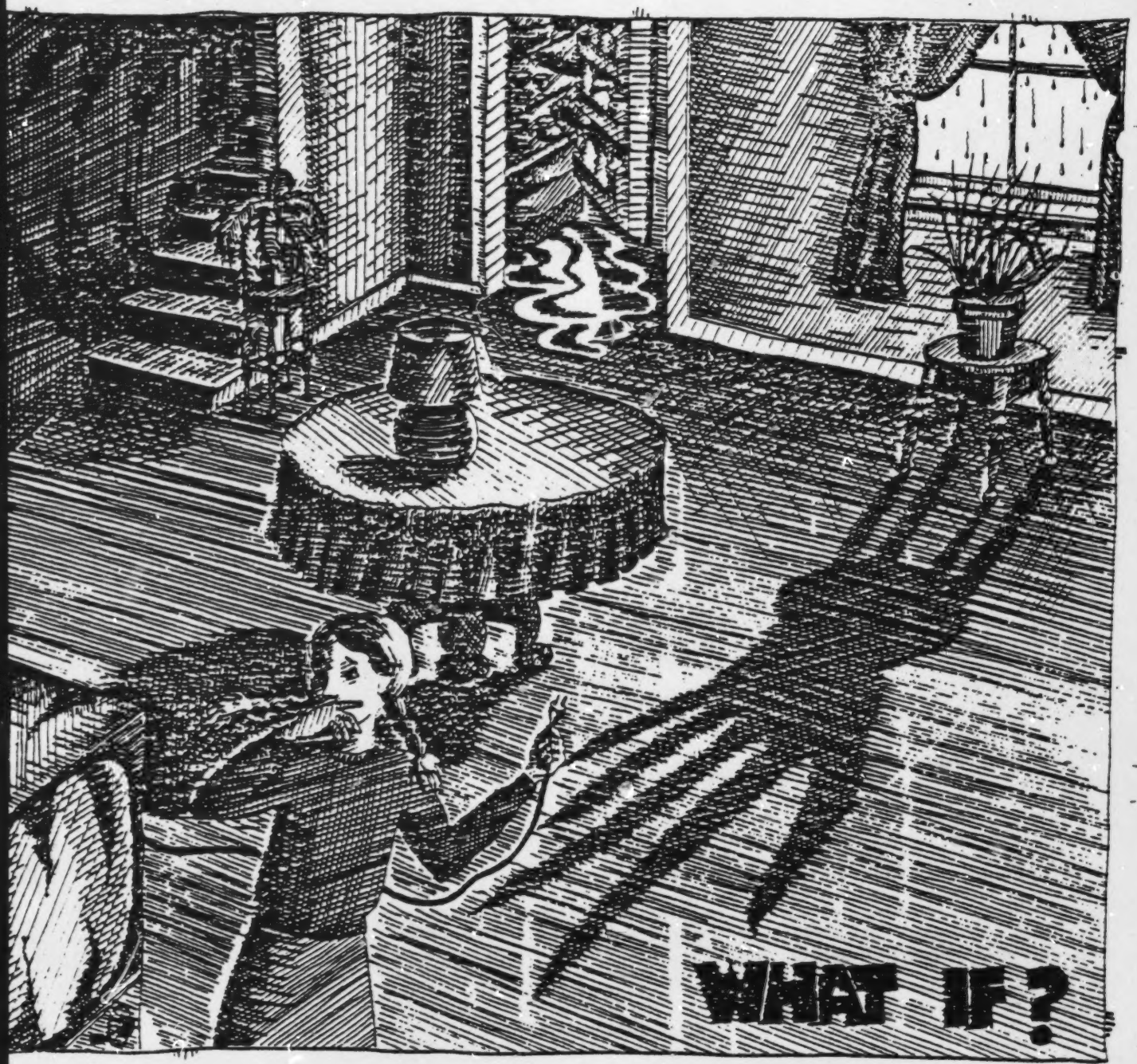
Electrical Appliances

Electricity is produced with non-renewable energy sources. I feel that children should become aware of and think about their use of electricity.

Make individual lists or a class of all the electrical appliances used in the home. You will be amazed at how long the list is!

Have students draw pictures of the electrical appliances listed. Use the pictures for a bulletin board or book.





agine coming home from school afternoon. It is a cold, rainy day. walk in the house and it seems No lights are on. You go to the erator for a snack. The light n't go on when you open the and the milk carton you take out n't feel very cold. You turn the television on, but there is no sound. no picture. You check the cord. It's plugged in. Soon you realize there is no electricity in your house: in fact. the whole neighborhood is experiencing a blackout. No one knows when the power will be restored.

Write a story describing what happened to cause the blackout and how the people in your neighborhood react to it. There will coviously be many disadvantages. Can you imagine any good things that could come from a blackout?

From: Connections

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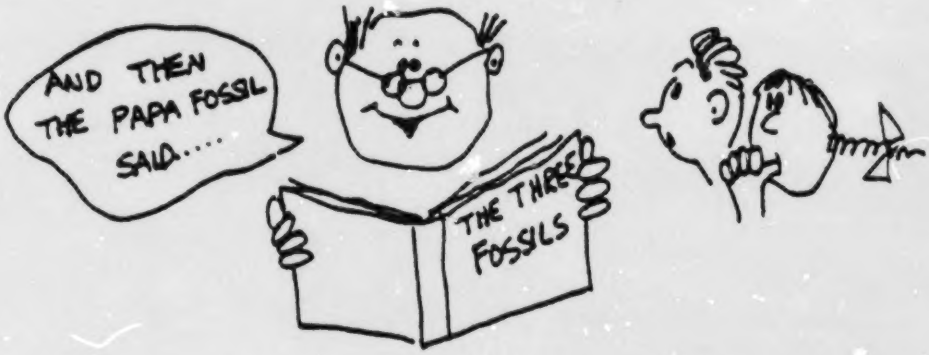
III. ENERGY PROBLEMS: NON-RENEWABLES AND POLLUTION

NON-RENEWABLE

Most of the energy that we use comes from non-renewable sources. Use the following activity to help students understant the concept of "non-renewable".



Trees' Energy

Show students a piece of wood. Explain that a tree gets its energy from the sun. If you build a fire with the tree, the burning wood and energy will change into ashes, smoke and heat. Can you change the ashes, smoke and heat back into a tree? No!!! The tree and the tree's energy are gone.

Presto, Chango

Show students a burning candle, piece of charcoal and a picture of a car. Explain how the energy in each object can be changed into heat and smoke and can't be recovered and used again.

POLLUTION

Energy use can cause pollution. The three following activities help students to understand pollution.

Catching Pollution

Spread a thin layer of vaseline on the unlined side of some white file cards. Put the cards outdoors in different places. After 24 hours, check your cards for visible signs of pollution.

Car Exhaust

Put a white sock over the exhaust of a car that has been parked for a while. Ask the driver to turn on the engine for one minute. The white sock will show visible pollution but some car pollution is invisible. Yuck!

Every Person's Air

Every person alive uses 6,000 gallons of air a day, just breathing in and breathing out. The same air has been used over and over again by all the people, plants and animals on earth, for thousands of years. As an exercise, have students brainstorm names of people, plants and animals that have shared the air with them. Use brainstorm ideas to dictate and illustrate group or class books.

Who Shares My Air?

A shares my air.

A shares my air.

A shares my air.

IV. CONSERVATION

Each student can do something to save valuable energy resources. Have each student individually list what can be done to use less energy in class, or at home or brainstorm the list.

Class Conservation List

1. Turn off lights when not needed.
2. Turn off the TV when not being watched.
3. Use a hand can opener.
4. Ride by bike instead of asking for a ride.

Make your own class list!

1.
2.
3.
4.
5.

"Hidden" Energy Use

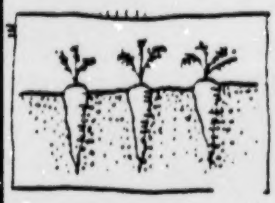
It takes a lot of energy to produce consumer goods. The exercise on the next page will help students understand that concept.

Following "HIDDEN" Energy Use are a number of activities for saving energy and resources based on the three R's—"Reduce, Reuse and Recycle".

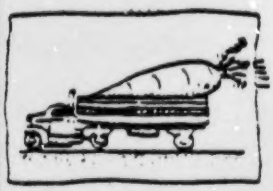
"HIDDEN" ENERGY USE

When we buy food and other household items we usually don't think about all of the energy used in producing and transporting these items. The following story will help students think about the energy needed for consumer goods. As you read the story put up the corresponding pictures on a pocket chart.

To conclude the activity, use the pictures in sequence to help the children retell the story in their own words.

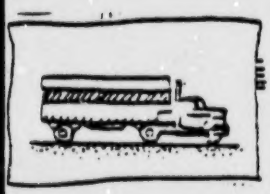


① A farmer grows carrots.



② A truck takes the carrots to a processing factory. The truck uses energy from gasoline to move.

③ At the factory machines slice, package and freeze the carrots. The machines use energy from electricity to work.



④ A refrigerated truck takes the carrots to the grocery store. Energy from gas is used to keep the inside of the truck cold.

⑤ At the grocery store the carrots are kept frozen in a freezer. Energy from electricity keeps the freezer cold.

⑥ You drive to the grocery store to buy carrots. Energy from gasoline makes your car move.

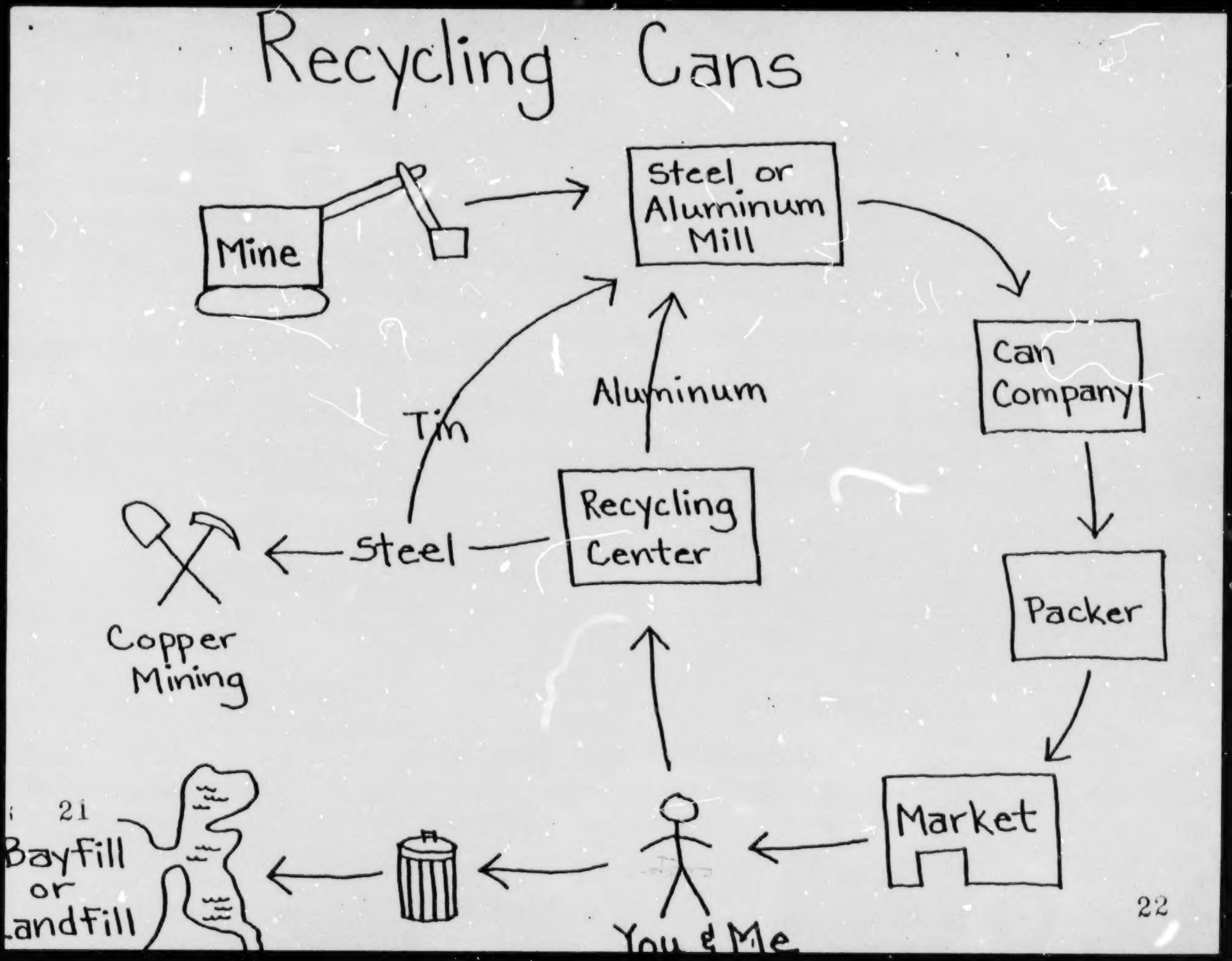
⑦ You drive home with the carrots.

⑧ You cook the carrots. Energy from electricity (or gas) makes your stove hot.

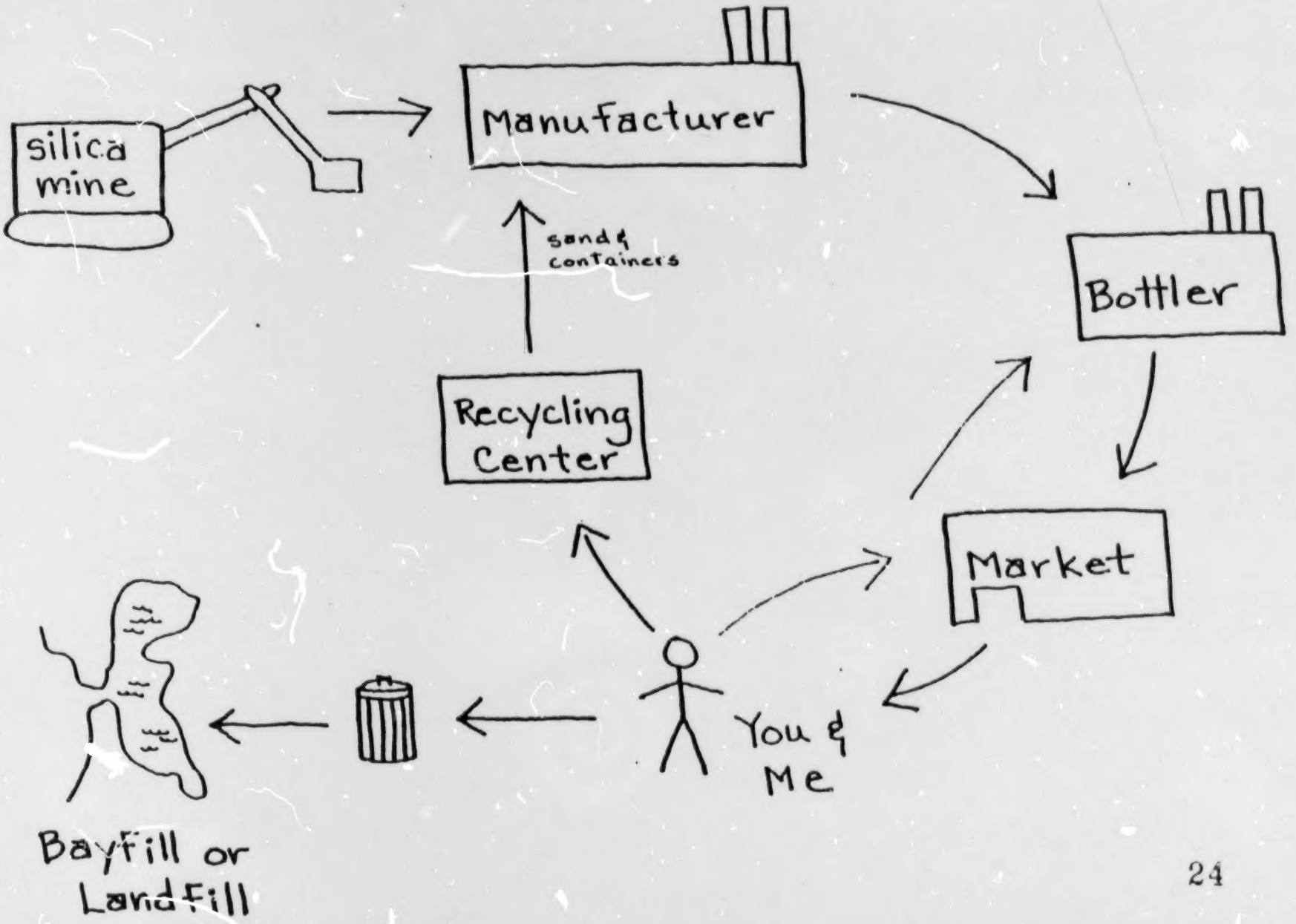
⑨ You eat the carrots!

Illustrations from Connections

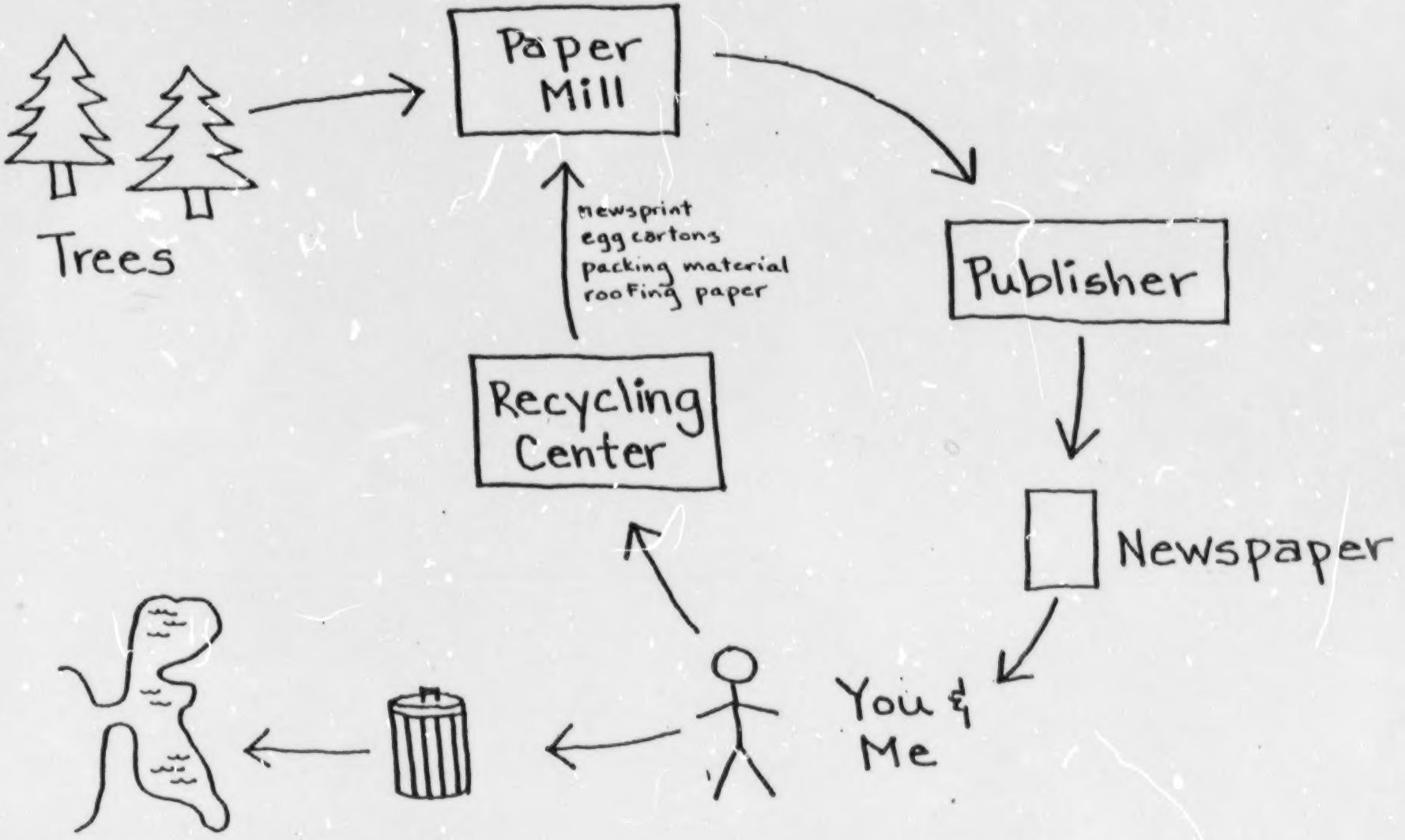
Recycling Cans



Recycling Glass



Recycling Newspaper



Decomposition (CHANT)
(natural recycling)

Verse
"Is there waste? Well I don't know.
One thing dies to let another grow.
The circle we see almost every day.
The name that we call it is decay!
Come on all you people now get down, break down and listen
to DECOMPOSITION."

Chorus (5 times)

Group 1. "Decomp - Decomp - Decomposition"
Group 2. "Get down, break down, Decomposition"
Group 3. (Have students snap fingers and make "bug noises.")

Verse
"There are many kinds of bugs,
worms and snails and banana slugs.
But they are useful to me and you.
They help make the soil renew.
Come on all you people now get down break down ad listen
to DECOMPOSITION."

Chorus

Verse
"Decomposition is a useful game.
A tree drops its leaves but doesn't stay the same.
A bug chews it up and spits it back out.
Making the soil a new tree to sprout.
Come on all you people now get down, break down and listen
to DECOMPOSITION."

Chorus

Reuse That Jar!

Students ask friends, neighbors and relatives how to reuse glass jars. Make a class list. Put copies of the list up in a local grocery store.
Try making lists for other "waste objects".

Old Bag Art

- Decorate a bag with magic markers, paint or cut-outs and use it for a lunch sack. See how long you can make it last!
- Use old bags to cover school books. Decorate the covers.

Recycled Paper

Recycling paper uses 50% less energy than making new paper. Each ton of paper recycled preserves an acre of harvestable trees.
Make paper with your class.

Cloth Lunch Bags

Use fabric scraps donated by parents to hand-stitch individual lunch bags.
Use embroidery thread to sew on names. Cloth lunch bags can be washed!

cloth lunch bag

Classroom Waste

At the end of a school day, sort through all the garbage in your class garbage can. Students discuss ways to reduce the amount of waste. Develop and implement a class waste reduction program. Trade garbage cans with another class.

Ways to Help Solve Solid Waste Problems

Revise

1. • buy products without fancy packaging • buy soft drinks in returnable bottles
2. • buy products with the recycled symbol • carry small purchases home without a bag
3. • buy products in one large package or container instead of several small ones
4. • buy products that will last longer (durable pens, clothes, toys)
5. • buy fewer disposable paper products (paper towels, napkins, plates, cups)

Reuse

1. • give old clothes, toys, etc. to charities • sell old furniture, bikes, etc.
2. • use lunch sacks more than once • return grocery bags to the store
3. • use grocery bags for trash sacks • fix broken appliances, toys, etc.
4. • share things you don't want anymore with friends • write on both sides of paper
5. • use jars, boxes, plastic containers again before throwing them away
   • use disposable products like plastic cups, paper towels, tin foil, more than once

Recycle

1. • take newspapers to the recycler • take tin cans to the recyler
2. • take cardboard to the recycler
3. • take returnable bottles back to the store
4. • take glass jars and bottles to the recycler
5. • take aluminum cans, dinner trays, pie plates, and other aluminum products to the recycler

---

Things I can do to help:

1. I can buy candy with less packaging.
2. I can reuse my lunch bags.
3. I can recycle aluminum cans.

Why I should do these things:

1. It will save natural resources.
2. It will reduce the amount of trash going to the landfill.
3. It saves energy to recycle cans.

Why it might be hard to do these things:

1. I really like Zoomo Bars, not the kind with less packaging.
2. I have to remember to take my lunch bag home.
3. I have to carry the cans home from school and play.

Things I've decided to do:

1. I probably won't buy the candy without extra packaging because I like Zoomo Bars better.
2. I will reuse my lunch bag at least once.
3. I will save the aluminum cans I use at home.

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SUGGESTED ANSWER KEY FOR "THE REDUCING GAME"
From: Trash Monster

Card	Solid Waste Item	Recyclable	Reusable
1.	aluminum can	x	
2.	aluminum pie pan	x	• can be used to bake in again • can be used for plant saucer • can be used as a pet dish
3.	aluminum lawn chair	x	• can be fixed
4.	apple core		• can be used in compost pile
5.	bicycle tire		• can be fixed
6.	book		• can be given to friend • can be given to charity • can be sold at garage sale
7.	bread		• can be fed to birds or ducks • can be used in compost pile • can be used for bread dough art • can be made into bread crumbs
8.	cereal box		• cardboard can be used for art projects
9.	clothes hanger		• can be used for wire • can be used in art projects • can be used to open up clogged drains, etc.
10.	corrugated cardboard	x	• can be used to put things in • can be used to ship things in
11.	cotton shirt		• can be used for rag • can be given to charity • can be mended • can be used to make rugs, dolls, or quilts
12.	egg shells		• can be used in compost pile • can be used for Easter art projects • can be used to plant seeds in
13.	flowers		• can be used in compost pile • can be made into dried flowers

14.	gift box with wrapping paper		o can be used in compost pile o box can be used to store letters, toys, jewelry, shoes
15.	glass bottle	x	• can be used for art projects
16.	glass jar with lid	x	• can be used for bug jar, bank, terrarium, etc. • can be used to put grease in
17.	glass jug	x	• can be used for water, juice, etc. • can be used for terrariums
18.	grocery sack	x	• can be reused for groceries • can be used for trash • can be used to wrap packages, cover books, etc.
19.	leather shoes		• can be fixed • can be given to friend or charity • can be sold at garage sale
20.	leaves		• can be used in compost pile • can be used in art projects (prints, arrangements)

Card	Solid Waste Item	Recyclable	Reusable
21.	magazine		• pictures can be cut out for art projects and scrapbooks • can be shared with friends • can be given to hospitals, etc.
22.	mail		• can be used for scratch paper
23.	margarine tub		• can be used as a container for leftovers,etc. • can be used as pet dish
24.	meat scraps		• can be used in compost pile • can be fed to pet dog or cat
25.	milk carton		• can be used to make candles • can be used as plant containers
26.	mirror		• can be used in bird cage • can be given to charity • can be sold at garage sale
27.	newspaper	x	• can be used to wrap things • can be used to cover things when painting

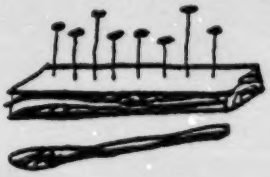
28.	nylon pantyhose		• can be used to make dolls or rugs
29.	paper towel tube		• can be used for toy • can be used for arts and crafts projects • can be used to hold electrical cards
30.	phonograph record		• can be given to friend or charity • can be sold at garage sale
31.	plastic bottle		• can be giveb to friend or charity • can be sold at garage sale
32.	plastic bag		• can be used more than once • can be used to store food, small items, etc.
33.	plastic toy		• can be fixed • can be given to friend or charity • can be sold at garage sale
34.	potato peels		• can be used in compost pile
35.	styrofoam food container		• can be used to make jewelry boxes, etc.
36.	tin can	x	
37.	toaster		• can be fixed • can be given to charity • can be sold at garage sale
38.	toothbrush		• can be used for cleaning jewelry, tile, etc. • can be used as a small pet brush
39.	wooden table		• can be fixed • can be used for firewood • can be given to charity • can be sold at garage sale
40.	wool hat		• can be mended • can be given to charity • can be sold at garage sale • can be used to make rugs or afghans

Junk Band Music

From: Get Your Hands on Energy

Have a few musical days with your class, starting it by making musical instruments from recycled materials. First, the class can generate new ideas about instruments by brainstorming. You can give a few suggestions to start them thinking. A band should have a percussion section, string section and maybe horn or "wind" sections. There will probably be a lot of percussion instruments since these are usually the easiest to make. Everyone should make an instrument, then get together and compose or improvise a tune.

Here are some ideas for instruments:



1. A coffee can plus innertube drum.
2. A flower pot (or tin can) bells.
3. Sand paper blocks (rub together).
4. Fill plastic bottles with rice, pebbles or sand for different sound shakers - moraccas.
5. Use a washtub bass made from an old washtub, broomstick and string or nylon cord.
6. A nail scraper (different sized nails in a block of wood).
7. A rubberband banjo.
8. Button finger cymbols.
9. Spoons (played 2 at a time) use wood or metal for different sounds.
10. A bottle cap tamborine (use bottle caps, string and pie pan).
11. Water xylophone - fill jars with different amounts of water, line them up and tap, ding-dong.
12. A thumb piano, with popsicle stick "keys".
13. Chimes, using scrap metal, nails or glass pieces.

Everywhere Is Somewhere

When you throw away a glass bottle,
or an aluminum can,
you have not really thrown it "away."

A broken piece of glass on a path
is somewhere—
it is there.
When you walk along that path,
even years later,
you can step on the glass and cut yourself.

A can thrown behind a rock is there,
even if you can't see it.
It will go on being there
for hundreds and hundreds of years.

On the land,
everywhere is somewhere.
Nowhere is "away."

From: Save the Earth

How The Trash Pile Grows

Buy it,
try it,
throw the trash away!

Take it,
break it,
throw the trash away!

Get it,
use it,
finish it,
lose it.
Wear it,
tear it,
throw the trash away!

Soda pop,
box top,
once you start
you can't stop.
Buy it,
show it,
nothing left but throw it:

Throw the trash away!

(Oh, no—where is "away"?)

From: Save the Earth

V. ENERGY FROM THE SUN

Meet Mrs. Sun

Use a sun puppet or sun mask for all of the following dialogue.

Props—one celery stick, tree branch, wind puppets, toy dinosaur, toy car.

"Hello boys and girls. My name is Mrs. Sun. I don't want to brag, but I am a very important source of energy."

(Hold up celery) "Plants don't eat like people do. Instead they use sunlight for energy to grow and stay alive. If there were no plants, what would people eat? You people certainly need me!"

(Hold up tree branch) "As a tree grows it stores sun's energy in its wood. When the wood is burned, it releases the sun's energy as heat."

(Hold up wind puppet) "The sun's heat makes wind. The wind moves many things. The wind's energy can even be used to make electricity."

(Hold up dinosaur) "Long ago, when the dinosaurs were still alive, plants and animals used the sun's energy. When they died, sun's energy was stored in them. Today some of these old dead plants and animals with stored sun's energy have changed into coal, oil and gas."

(Hold up toy car) "When we use gasoline in a car we are using very old sun's energy to make the car go!"

"By myself, I can keep you warm and give you light. I can be used to heat your home and heat your water. You must agree that I'm really quite wonderful!"

Make a Sun Mask

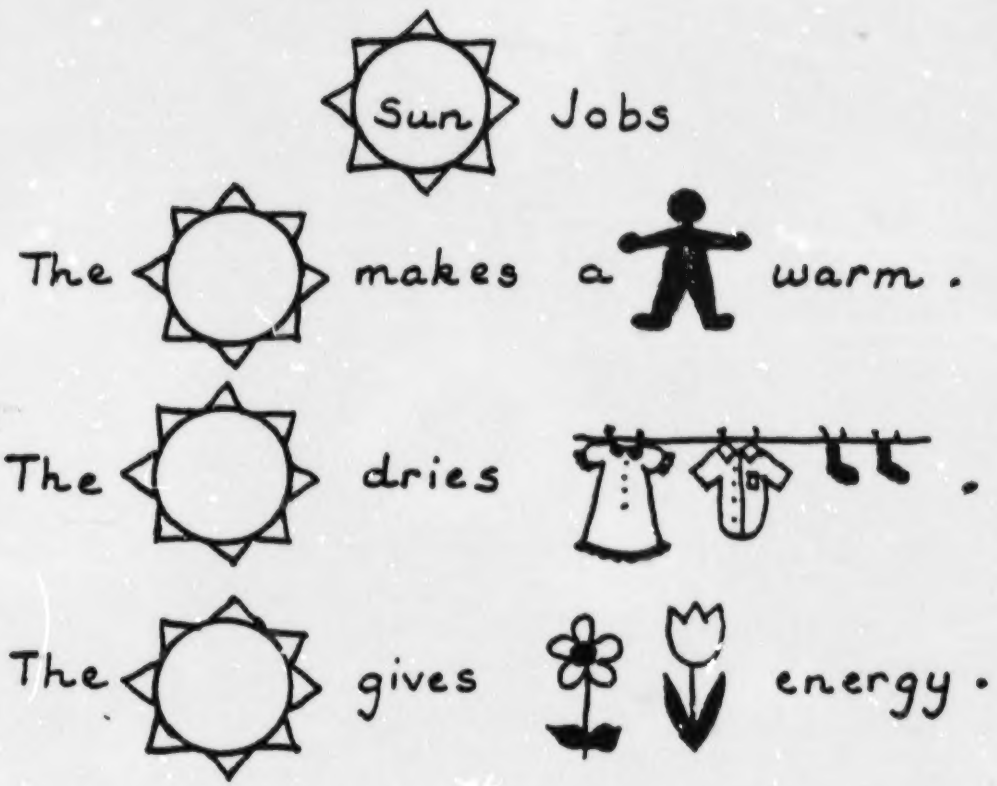
Glue two pieces of orange construction paper together. (This provides flexibility and strength.) Cut out a sun with a center hole just big enough to fit around your face. This mask should stay around your face without holding it.

Make A Sun Puppet

Cut two identical sun shapes out of yellow construction paper. Glue the two suns together leaving an unglued sleeve at the bottom that is large enough to insert half the length of a chopstick. Color a sun face on one or both exposed sides. Store this puppet in a file folder and just insert a chopstick (pencil, ruler, etc.) when ready to use.

Sun Jobs

What jobs does the sun do? Make a sun jobs chart or book with students. Below is a sample of how the chart may look with three examples.



The Fable of Max

Once there was a little boy named Max. Max was an extremely lively young man who always accepted any challenge given him. He thought he could do everything bigger or better or faster, and he was always ready to prove himself.

One day Max saw a beautiful bird flying up in the sky. The bird would flap and flutter with hardly an effort, gliding on the winds. The bird saw Max on the ground. Max thought to himself, "I bet I can fly better than that bird." So Max found a tall tree and he climbed it branch by branch until he reached the top.

"Oh bird," said Max. "I can certainly fly better than you."

The bird just watched curiously as Max started flapping and leaped from the top of the tree.

"AAAAAAAAAAAAAHHHHHHHHHHH!!!!!!!PLOP."

"You can, can you?" asked the bird, still flying around in the clouds.

"I'll show you," said Max.

Max thought for awhile and finally thought of a way he could fly better than the bird. He bought some metal for wings, some rubber for tires and finally, a great big engine, for he was going to build an airplane.

When he finished building his plane, he took a can of gas and filled the tank of the plane, because, unlike the bird, Max needed gasoline to fly. He started the engine. Vrrrrrrrooooooooommmmmmmm. What a noise! Max got in his plane and off he went racing through the sky. The bird didn't like all that noise at all so he went away to hide.

"You see," said Max. "Now who can fly best of all?"

After awhile, Max got tired of his airplane and went for a walk by the ocean. There he saw a great whale playing in the waves. Up for a breath and then down to the bottom of the sea the whale would go, without a second thought.

"I can dive deeper than you," said Max.

The whale didn't understand how a human could dive deeper than a whale.

Max jumped in the water, and he and the whale took deep breaths and down they swam. Max swam and swam until he had gotten very deep and then he realized, "Oh no, I need a breath of air!"

Up to the surface he swam as fast as he could, "GAAASSPPP. OHH!"

"Hoooom Haaaaaar," laughed the whale. "I didn't think humans could swim like whales."

"I'll show you," said Max, and he went off to build himself a submarine.

He bought heavy metals, air tanks and motors to run his machine. When he was all ready, he filled his little sub with gasoline for it too needed fuel to run. He jumped in and closed the hatch and down he floated in his submarine.

The whale was disgusted by all the noise and bubbles that Max's machine made so he swam down to the bottom of the sea to hide.

"Now who can dive the deepest?" Max shouted. But the whale was nowhere to be found.

After a time Max got tired of his submarine, and besides, he was kind of cold so he went off to the desert to warm himself. It was the middle of winter so he still didn't feel very warm. He found a little lizard who was lying on a big rock in the sun.

"How do you keep warm?" asked Max.

(continued on next page)

"I lie on this rock in the sun, and when the sun goes down I crawl underneath the rock where I stay warm all night long."

"Huh! Well I can do better than that." And Max went about building himself a house. He bought wood and windows, stone and nails, but he didn't insulate to keep the house warm. He realized his house was still cold, so Max brought in a giant gas furnace that growled and spurtled as he lit it.

"There," said Max. "Now I am warmer than you.

"The little green lizard just lay there in the sun.

One day Max was off flying around in his airplane, zooming across the sky. He was leaving trails of smoke wherever he went. He was looking for a bird to race. Suddenly the engine went putt-putt, sputter-pop.

"Oh no!" Max thought. "My plane is out of gas!"

VRROOOOMMMMMMMM-Splat. The plane and Max crashed to the ground. All of a sudden it was very quiet. The little bird poked his head out of his nest.

"Ahh, tweet tweet," said the bird. "Now who can fly best?"

Off the bird went floating in the breeze as happy as ever.

Max went off to the ocean to have a little trip in his submarine. Down he went bubbling all the way. When he got to the bottom of the sea he searched around for the whale. At last something happened.

"My! Cough! Cough! It's getting rather hard to breathe! OH NO!! The submarine is out of gas too!"

Max opened the hatch and up to the surface he swam for a breath of air.

"Gasp!"

"Hoooom Hoom Haaaaar," said the whale, who had secretly watched this.

"Now who can swim the deepest?" The whale did a flip out of the water with a great splash and dove down to the bottom of the sea where all was quiet and peaceful again.

Now Max was really wet and cold and very disappointed in his machines. He hated being outdone by animals. He went to his house and sat down by the heater to get warm. He was shivering.

"Ahh," thought Max. "At least I can stay warm here."

Putt, sput, sput, pop.

"Oh no, not again," Max moaned. "Even the gas furnace is out of fuel."

Now the cold wind blows in through the cracks in the walls that Max never fixed.

"Oh, woe is me. What will I ever do now?"

Max then looked out the window, and there was the little green lizard sitting in the sun, warm as ever. Max had an idea. He got a bunch of windows and put them on the south side of his house. He bought some stones for the floors and walls to trap the heat that was pouring in through the windows, and he put up big pads of insulation to keep his house warm.

"There we go," said Max. "This time I learned something from the animals."

The lizard liked Max's house now and he came in. The little green lizard and Max fell asleep together lying in the sun where it was so warm and nice.

-Shaun Taylor

From: Get Your Hands On Energy

VI. EXPERIMENT WITH SOLAR ENERGY

The following activities will help students to understand the uses and potential of solar energy.

Plants As Solar Collectors

When we build a solar collector we have to use common sense to face it in the right angle and direction. To show how plants face the sun, take a teaspoonful of alfalfa seeds and soak them overnight. Place them on a moist paper towel in a bottle by the window. After a few days you will notice that each little plant is facing its "solar collector" (leaves) towards the sun.

Hot Cans

1. Collect pop cans and paint them various colors. Fill each with water and place them on a sunny window sill. After several hours measure the temperature of each can. Graph the results to see which can gained the most heat. Discuss the results.

2. Experiment with felt insulation to see how different amounts and locations of insulation effect temperature. Graph and discuss results.

3. Place a can in a sealed jar, a can in an unsealed jar and leave one can without a jar. Experiment as you did in #1.

4. Combine various combinations of color, insulation and glass to see how high you can get the temperature of water in a can to rise.

Solar Food On a Clothesline

Each child wraps a few thin slices (max. 1/2 inch) of fruit in cheesecloth. This bundle is then enclosed in a larger cheesecloth "bag" to keep out insects. Suspend each fruit bundle with a clothespin to a clotheline. Let dry for several days.

Also try vegetable slices. Yum.

Car Colors

Test outside and inside colors of teachers' cars to see which colors absorb and reflect the most heat.

MAKE A RAINBOW MURAL IN WHICH EACH COLOR IS COMPOSED OF OBJECTS OF THAT COLOR

Sun Shadows

Sun Shadows are pretty amazing. They do many things. A shadow is similar to a hole in the ground; its identity comes from what it isn't, not from what it is. It is a no-sun spot. Let's examine shadows and see if we can make them do some tricks for us. Playing with them is a good way to learn how they happen and how they behave.

Shadow Hunt

The youngest children may not understand shadows at all. Go outside on a discovery walk with them. Pick a good sunny day and ask these questions:

Does everyone have a shadow?
Does everything have a shadow?
Can you make your shadow disappear?
Can you make your shadow larger or smaller?
Is night a shadow?
Is a cloudy day a shadow?
Can you make two people cast one shadow?
Why is night cold and day warm?
Make "shadow friezes" by lining up several bodies.

Experiment with possible designs. Try this again later when the sun angle has changed and see the difference.

Have the children find two objects that have the same shadow form but very different 3-D shapes.

*People who design and build solar houses have to be shadow "experts". Have the children look around and predict where shadows will fall as the sun goes down.

*The Charwoman's Shadow by Edward Dunsany is a great shadow appreciation story.

From: Get Your Hands On Energy

Adapted from: Get Your Hands on Energy

Sun Tea

9A.M.
SUN TEA!
2:30 P.M.
THE BOTTLE CASTS LITTLE SHADOW IN THE AM - IT IS CLEAR WATER. AS TEA BREWS, WATER DARKENS & BEGINS TO CAST A SHADOW. WHERE IS THE LIGHT GOING?
• TAP WATER & TEA
• GALLON JAR
• NOW... DRINK IT WITH ICE!

Shadow Pictures

You need chalk and a playground you can draw on, or crayons and large sheet of newsprint. Once child is the artist while the other is the model. The artist traces the shadow of the model on the playground or on the paper. They then trade places and decorate the silheuette with shadow cloths or patterns. They may hold leaves or other objects to cast shadows within the figure and turn them to see how the shadows change. You can also trace face shadows in the same manner.

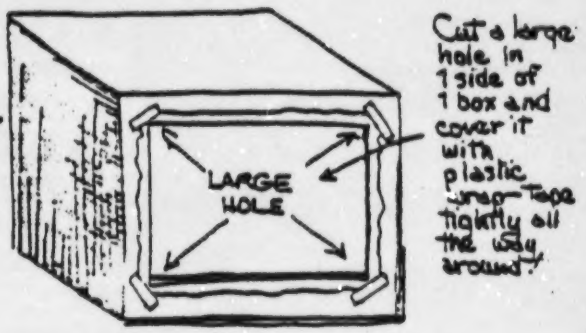
X Marks The Spot

For a better understanding of the movement of shadows, put a small tape X on a classroom window. Place a corresponding X on the floor where the shadow is cast. Record the position of the shadow at different times of the day, also at different times of the month or year. What conclusions can be drawn from this? If the shadow penetrates farther into the room in winter then so will the sunlight. What implications does this have for solar heating?

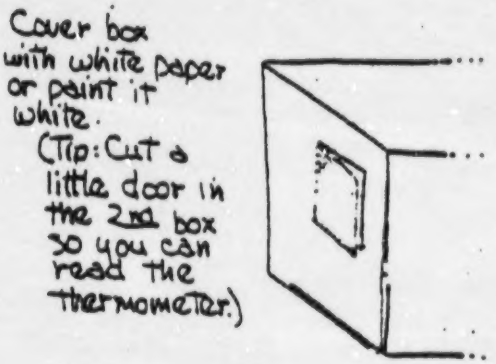
*HOW MUCH HOTTER DOES A HOUSE GET WHEN THE WINDOWS FACE SOUTH INSTEAD OF NORTH?

MATERIALS:

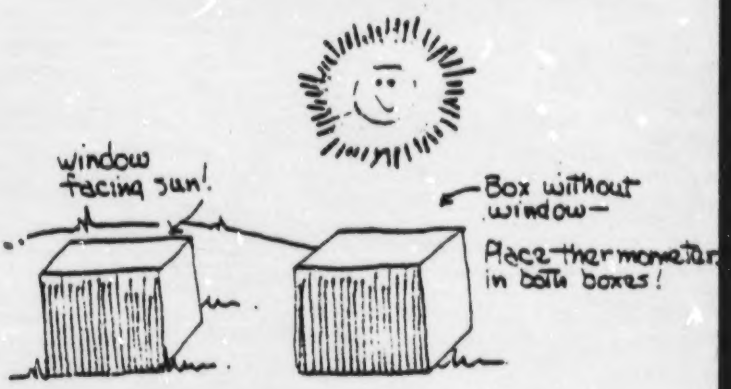
- 2 Cardboard boxes of same size
- White paint or paper
- 2 Thermometers
- Plastic wrap
- Masking tape



Paint both boxes white, or cover them both with white paper.



Place a thermometer in each box and put them in the sun.

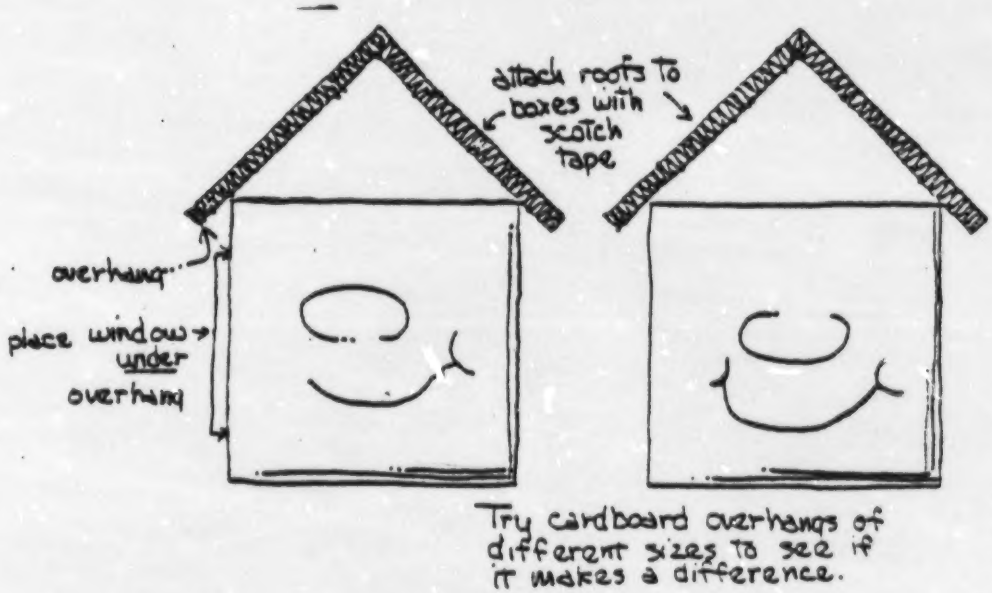


Record the temperature after 10 minutes, 20 minutes, and 30 minutes. What do you find?

Try this experiment at different times during the day.

Does this make any difference?

Add an overhang to both boxes:
Does this make any difference? How would the overhang affect this experiment at different times of the year?


attach roofs to boxes with scotch tape
overhang
place window under overhang
Try cardboard overhangs of different sizes to see if it makes a difference.

From: Science Activities in Energy

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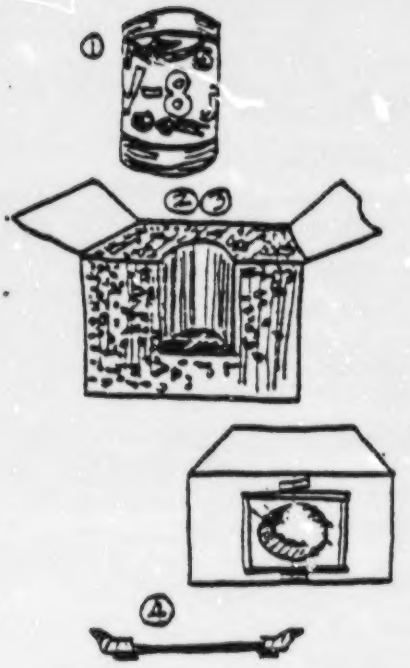


✱A Tin Can Solar Oven

If you already have a solar oven, let the the students figure out why it works. Place the oven near a cement wall and leave it there for a few hours to warm up. Bring the class out and have them feel the wall, then feel inside the oven. Ask them what they notice about the oven which might allow it to become so much warmer. With prompting, even 3rd graders can usually identify the four main features of the oven.

1) Clean out a No. 10 tin can and spray the inside black with heat-proof barbecue paint. This will be the cooking chamber.

2) Find a box that will be 3-6 inches larger than the can on all sides. The can will be placed in this box with insulation all around. Vermiculite, shredded paper and fiberglass duct insulation all work. Don't use styrofoam or any material which will break down at moderate to high temperatures.

3) Pack the insulation around the can tightly, close the lid of the box and cut a hole that fits the can snugly.

4) Find a picture frame with glass that is bigger than the can. Glue felt weatherstripping on the back to make a good seal with the front of the box and can.

5) Make a funnel-shaped reflector from posterboard or cardboard. Cut out the shape shown, glue aluminum foil shiny side out and staple it together along the straight edge. The funnel may be attached to the outside of the picture frame with tape or tacks.

6) Place the object to be heated inside the can, supported by a piece of chicken wire. Hold the reflector-frame assembly on to the front of the box with string loops which go around the box.

SUNSHINE COOKIES

1 c. butter
½ c. honey
½ c. brown sugar
2 eggs
1 tsp. vanilla
½ tsp salt
1 tsp. soda
2 c. flour
1 c. oatmeal
1 c. golden raisins
½ c. sunflower seeds

① cream butter and sugars together
② add eggs
③ mix in sifted dry ingredients, raisins & seeds
④ add vanilla
⑤ bake till done in SOLAR OVEN !!

From: Get Your Hands On Energy

* Solar Hot Dog Cooker

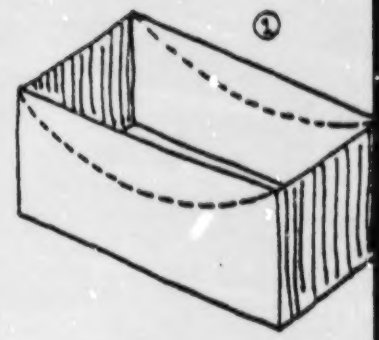
A reflective hot dog cooker can be built from a cardboard box, tin foil and posterboard. Sunlight hits the reflective surface and focuses on the hot dog held in the center. Students can work in pairs or individually if there are enough materials.

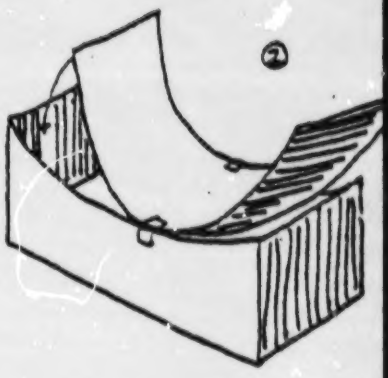
1) Select a long narrow box; the longer the box the more heat collection is possible. Choose a focal length between 5" and 10" and design a parabolic curve as described in the "Too Hot to Touch" section. One template could be used for all the cookers. Trace the curve on the open end of the box so that it is centered and straight.

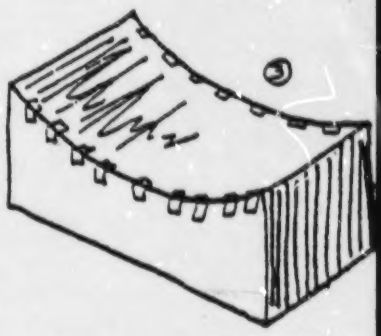
2) Cut out the curve with a utility knife. Stress the importance of being exact. Measure and cut a piece of posterboard that will fit flush against the opening to the box. Attach this with tape beginning at the center and working toward the edges.

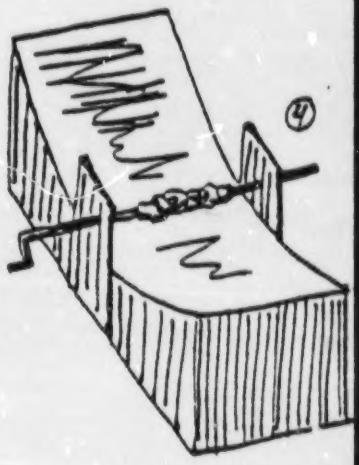
3) Cover the curve with white glue and apply aluminum foil shiny side out. Start in the middle and smooth toward the edges. Try not to wrinkle or fold the foil; you want it as smooth as possible.

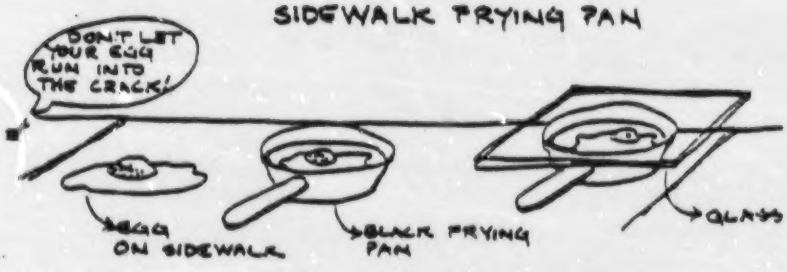
4) Use two scraps of cardboard taped to each side as supports. Using the sun or a projector light, test the focal point. There should be a bright spot on the supports where light is concentrated; mark this spot and punch a hole for the skewer. Use a section of a coat hanger from which the paint has been removed for a skewer.











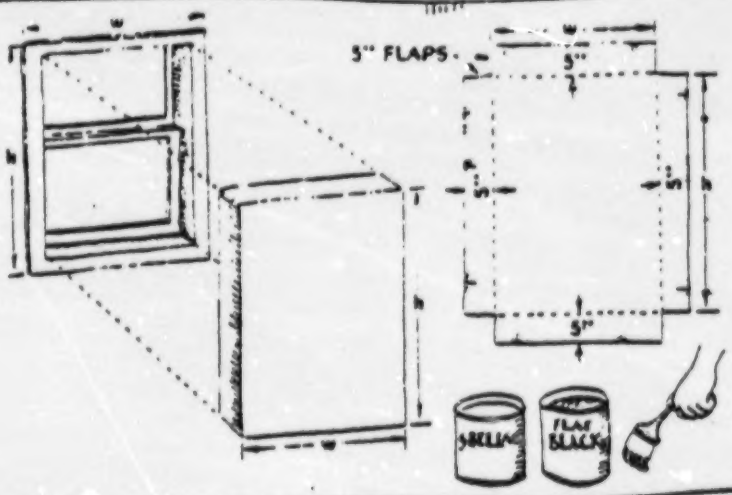
From: Get Your Hands On Energy

HOW TO MAKE A * SOLAR AIR HEATER

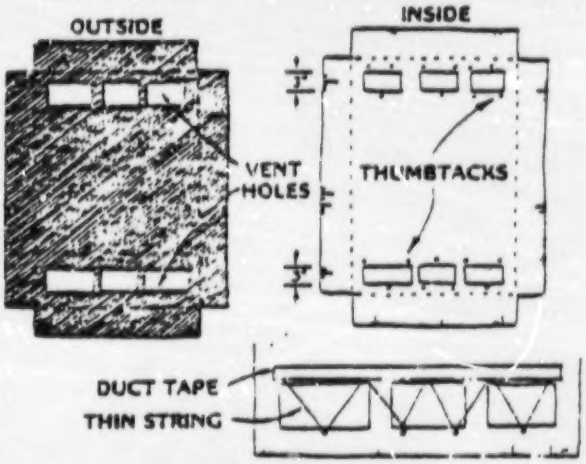
1 MEASURE A SOUTH-FACING WINDOW TO BE USED AND FIND A LARGE ENOUGH PIECE OF CARDBOARD

Cut the cardboard to fit snugly inside the window frame.

Brush one side with shellac, then after drying for 5-7 hours, paint it with flat black enamel or latex paint.



2 THEN MAKE THE VENT HOLES



Cut them near the top and bottom at least 3" high.

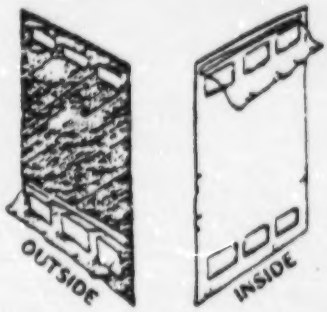
Push thumbtacks into the cardboard around the vent holes as shown.

Weave some thin string around the thumbtacks and across the vent holes.

Cover up the thumbtacks with silver duct tape to keep them from falling out.

Get some thin plastic film (like food wrap — but not wax paper) and cut it large enough to cover the vent holes.

Tape the plastic to the ourside (black side) of the bottom vents and to the inside (string side) and top vents as shown.



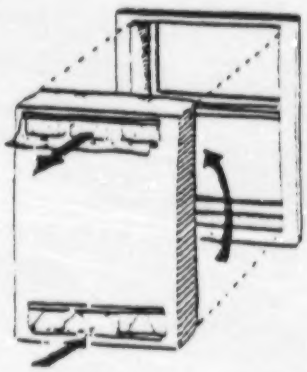
3 NOW YOU CAN INSTALL THE HEATER

Place the cardboard, black side facing the window, top vents up, (so that the plastic flaps hang down over the vent holes), then tape it to the window frame with masking tape.

Leave an air space between the glass and the cardboard, but none around the edges of the cardboard.

Don't leave the masking tape on the window frame too many days, or it may pull the paint off with it.

A smaller model can be made using a cardboard box taped to the window, leaving an airspace between the glass and the back of the box. Just follow the above directions.



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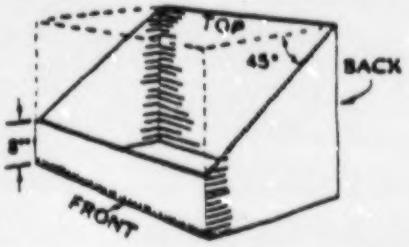
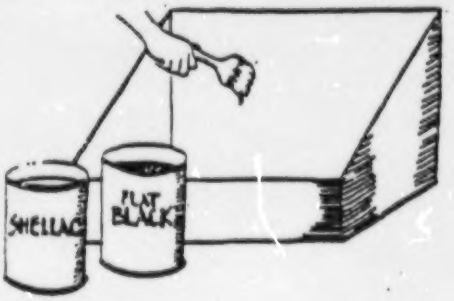
HOW TO MAKE A * SOLAR FRUIT DRYER

1 FIND THE RIGHT BOX

Find a box with dimensions that will leave about 8" in front when a 45 degree angle is made from the top corner.



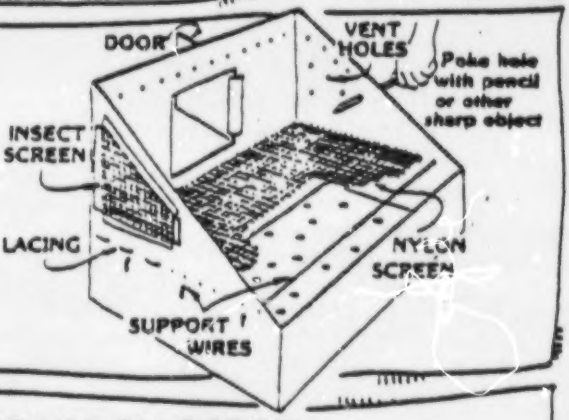
Cut a section out of the box as shown.
The entire inside of the box needs to be black. You can either glue black construction paper to the inside with "Elmers" glue, or you can paint it.
If you choose to paint, first brush on a coat of shellac, let dry for 5-7 hours, then paint with a flat black enamel or latex paint.



2 PREPARE THE BOX

Next, cut a door in the back of the box large enough to let your hand through, plus whatever you will be putting in to dry. Reinforce the uncut, hinging part of the door with a piece of duct tape.

Poke holes in the bottom and sides as shown with a sharp pencil. (about 30 holes).



3

Make 3 or 4 screen support wires out of a thick wire such as a coat hanger wire, and stick them through the box near the bottom as shown and bend down the ends.

4 THE NYLON SCREEN

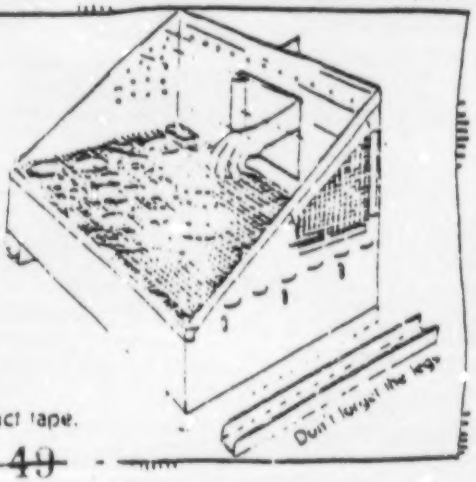
Get some nylon flyscreen material and cut it larger than the bottom of the box, so that the edges can be turned up and laced to the sides of the box.

5 GLAZING THE DRYER BOX

Use "Saran Wrap" or clear vinyl to cover the open top of the box.

Fasten the edges down with silver duct tape.

Make 2 legs out of cardboard and fasten them to the bottom with duct tape as shown.



INSECTS?

If so, cover the vent holes with more of the nylon screen and fasten it with duct tape.

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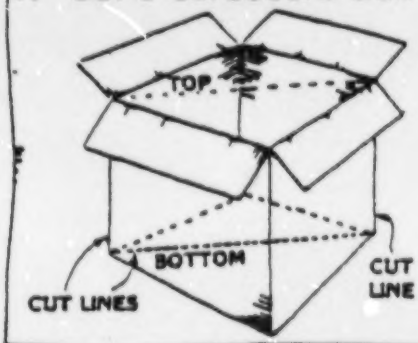
HOW TO MAKE A * SOLAR WATER HEATER

1 Cut a Cardboard Box in Half Diagonally:



Cut the box in half along the diagonal as shown, leaving a triangular shaped top & bottom. Then cut off the top triangle.

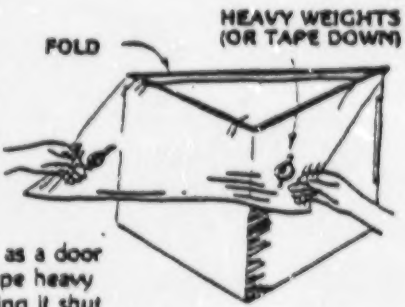
The left-over piece has two sides that can be cut out to fit flat onto the sides of the remaining half-box. Glue alumninum foil to these two pieces with Rubber cement (be sure to read the directions on the label), then tape them to the sides of the half-box. These side pieces will add some thickness to the walls & help keep heat inside.

Cover the bottom with alumninum foil in the same manner.

2 Glazing the Box:

Tape a small stick of wood with silver duct tape across the top corners of the heater box as a brace.

Use Saran Wrap or clear vinyl & tape it to the bottom & sides of the box as shown. Make sure it is cut long enough to have some left over to fold over the top.



The fold-over flap can be used as a door to get into the box. You can tape heavy weights to the corners for holding it shut or just use tape for as long as it sticks.

3 The Water Can

Use any can, about 1 quart size & without leaks.

Peel off any labels & rub the can with steel wool or fine sandpaper to dull the shiny finish.

Brush the can with a metal primer, let it dry completely, then paint it with a flat black enamel or latex paint.

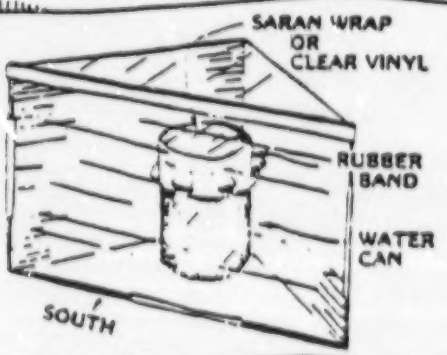
4 Set Up the Water Heater

Open the top of the heater box.

Fill the water can, cover the top of it with Saran Wrap or clear vinyl, & wrap a rubber band around the top of the can to seal it.

Place the filled can on the bottom of the heater box & close the top flap. Be sure it is well-sealed.

Face the front of the box to the south & wait for it to heat up. You can test the temperature of the water by sticking a thermometer into it. You can also experiment with different colors or different kinds of water cans and jars.



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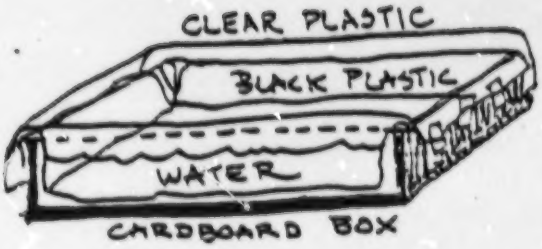
* Roof Ponds



If you dive into a lake in mid or late summer you will often discover a warm layer of water on top and frigid water below. The lake acts as a simple collector. The "roof pond" has been used extensively for heating water. In Japan, a black vinyl bag is sold for $12.00 and is simply placed on the roof with a hose running down from it. Students can make a simple collector from a shallow cardboard box which is lined with black plastic and covered tightly with clear plastic.

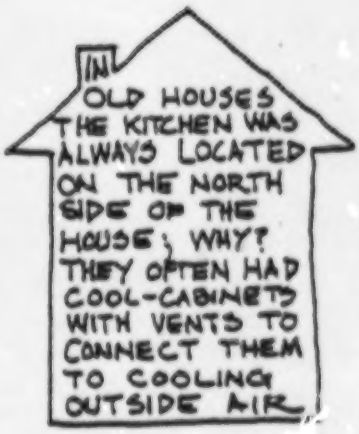
A more permanent model can be built with a wood frame, glass lid and insulation. Use a hose to fill the bond and when the water is warm enough siphon it out. Try using aluminum foil reflectors to increase temperatures.

Some of these more complicated projects should be made by an adult or older students. The completed projects are valuable teaching tools for primary students.

VII. EXPERIMENT WITH INSULATION TO CONSERVE ENERGY

"My, But You Have An Icehouse"

Before mechanical refrigerators were available, people couold still enjoy a glass of iced tea in the middle of summer. How was this possible? The cold north winds did the freezing in the winter. People would cut the ice from lakes and bring it to a special building, the icehouse. The ice was stacked in piles covered thickly with straw and sawdust. As the year warmed up, the iceman would bring lumps of cool clean ice to peoples' homes. The lump of ice, together with food, were stored in an insulated cabinet, the icebox. It costs 15 cent for electricity to freeze 100 pounds of ice. Why don't we let nature make our ice for free like our grandparents did?


IN OLD HOUSES THE KITCHEN WAS ALWAYS LOCATED ON THE NORTH SIDE OF THE HOUSE; WHY? THEY OFTEN HAD COOL-CABINETS WITH VENTS TO CONNECT THEM TO COOLING OUTSIDE AIR.

Natural Houses

Earth sheltered and underground houses are cool in summer because the earth maintains a relatively constant temperature throughout the year. How would an earth sheltered house be in winter time? What other types of houses would be cool in summer and warm in the winter?

THE SEMINOLE INDIANS HAVE A HOUSE CALLED A CHICKE. IT HAS A THATCHED ROOF & NO WALLS, THUS ALLOWING FREE VENTILATION & SHADE FROM THE SUN.

Ice Race

Give each pair of students two ice cubes and tell them this is a game to see who can make their cubes last the longest. The key to this game is insulation. Try the following materials: sawdust, vermiculite, cotton, wool, straw, paper, milkweed or bulrush fluff, styrofoam cups, plastic or earth. What can we learn from this experiment about keeping warm?

THE JAPANESE HAVE WALLS WHICH ARE MADE OF PAPER & CAN EASILY BE REMOVED IN SUMMER.

Perhaps you would like to try a school icehouse or cool shed.

From: Get Your Hands On Energy

THE HEAT LEAK DETECTIVE GAME

TOOLS

1) a draft detector made by taping plastic food wrap to a pencil.

2) a note pad and pencil to jot down clues and findings.

FIND THE HEAT LEAKS IN YOUR SCHOOL

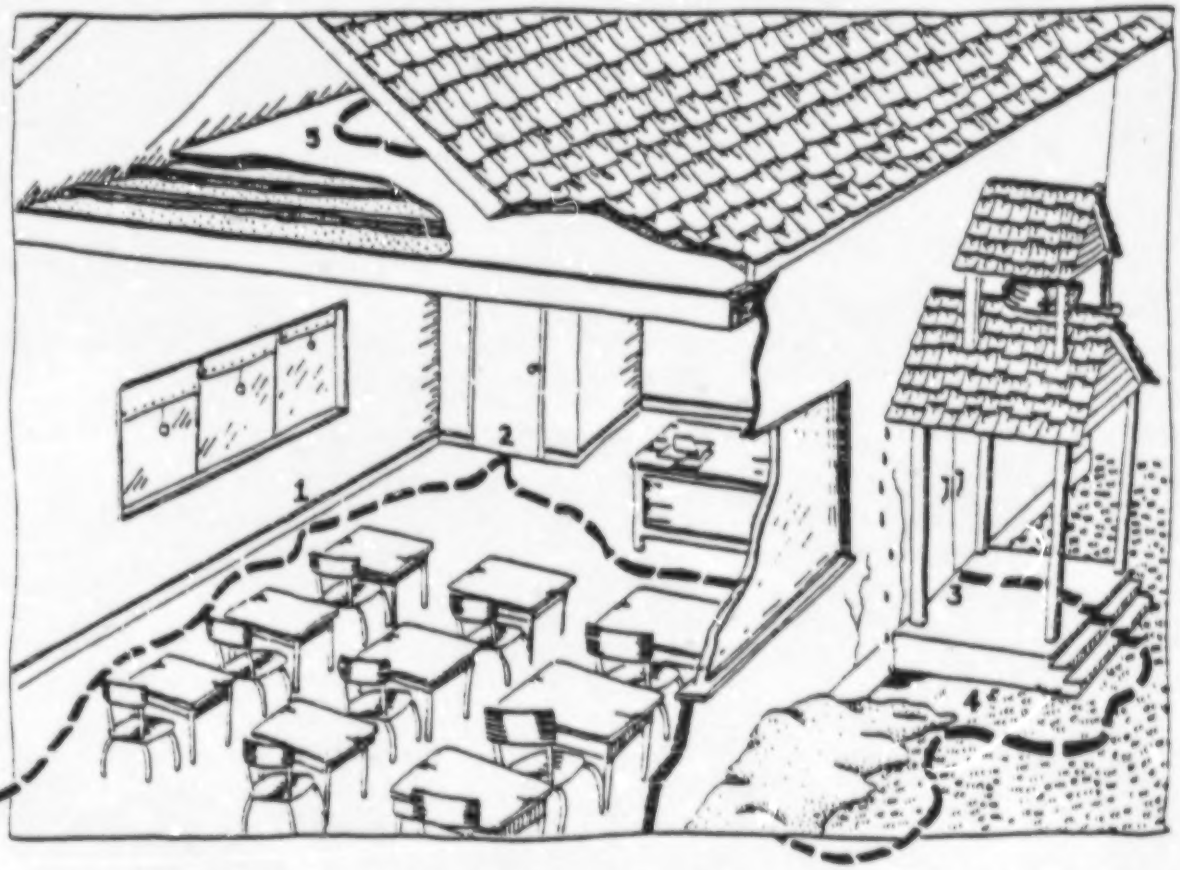
1) Search out drafts by holding the draft detector to probable leaks. Does the plastic move?

2) Write down the trouble spots and describe ways of plugging the leaks.

3) Return to class with your findings. Who in the class found the most leaks?

1 **Curtains or Shades:** Are curtains used at night to hold the warm air in? Could carpets or rugs contribute to keeping the air in?

2 **Storage Rooms and Closets:** Are the doors of storage rooms and closets left open? Areas not commonly used need not be heated and should be kept shut off from other rooms. Do their doors fit tightly, or is heat leaking into them?



3 **Windows and Doors:** Are doors or windows left open for no reason? Is there weather-stripping around doors, caulking around windows? Do the window frames fit tightly against the wall of the room, or is there heat escaping through cracks? Does the glass fit right in the frame? Are storm windows used in the winter? Are double door entrances used, with each door kept shut when not in use?

4 . **Outside the School:** Are there cracks in the brickwork or related breakage or disrepair in other construction materials? Earth piled against the wall can allow damp to penetrate the walls, requiring unnecessary heating. Is there water dripping or splashing against the wall? Do the windows and doors fit tightly from the outside?

5 **The Roof or Attic:** Is there insulation? Is the structure solid and closely lined? Are there gaps or cracks in the material? Is there a structural air gap?

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VIII. EXPERIMENT WITH WIND TO PRODUCE ENERGY

Wind can be used to generate electricity. Maybe one of your students will later do research in wind energy! Primary students should start experimenting with wind to understand that the energy in wind causes movement. Choose from the following activities.

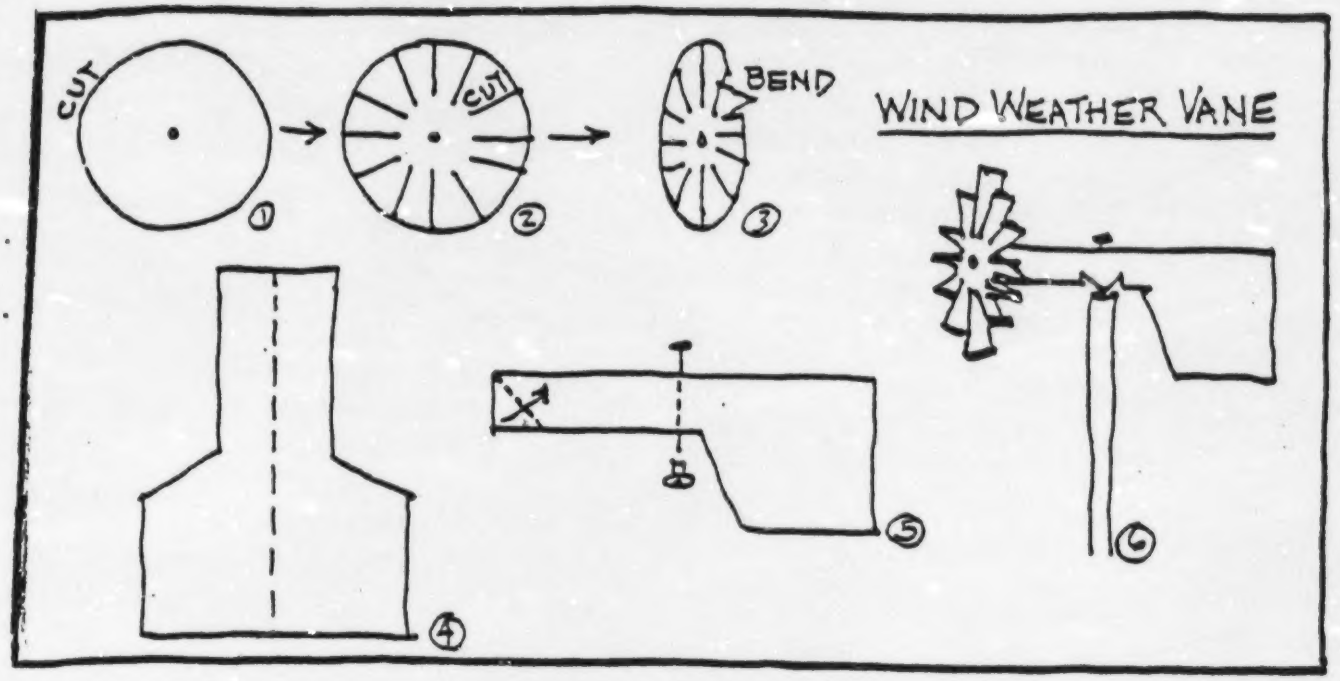
Wind Detectives

This exercise shows how the energy in wind creates movement. Most of the devices are things children are familar with, but they may not have associated them with wind.

Soap bubbles (make some weird bubble frames with wire)
Milkweed puffs or other wind-carried seeds
Pinwheels
Kites
Wind socks (make with cloth on a wire hoop or use a Japanese fish kite)
Flags and banners
Mobiles, wind chimes and bells (make these out of recycled materials!)

Simple Air Conditioners

Have students make simple fans. Go outside and do some physical activity so that children feel hot when they come inside. Use the fans to help cool off. Wet faces with a wet towel and fan for more effective cooling.



Wind Weather Vane

You can make a simple weather vane that serves as a windmill model, from aluminum printers' plates (used plates are available at newspaper offices) or cardboard. Cut a circular disc 8-12" in diameter. Make slits from the outside to within 1 1/2" of the center; these will form the blades when bent to a 45 degree angle. You can put a nail through the center for an axis, but this tends to wear out easily.

A partially "popped" rivet provides an axis and bushing in one step. Put a hole in the center and put a pop-rivet in it. Squeeze until the rivet has begun to expand but is still free to spin around the wire.

The tail vane is made from a piece folded in two, for double strength. The vertical pivot should be located in front of the broad portion of the tail vane. Use a tail as the vertical axis, making sure the whole windmill rotates freely around it.

Helix Magic

Does it seem that some times of the day are more windy than other ? Or that the wind is related to other weather conditions in some predictable fashion? The sun, in one way or another, is creating those up-drafts and air currents; it may be doing it locally or hundreds of miles away. In Montana there is a lot of variation with its wide open spaces and mountains.

Talk with the kids about solar energy warming the earth's surface and causing winds. Draw a few blackboard illustrations of plains and mountains. Use this simple exercise to demonstrate, on a comparatively microscopic scale, how hot air rises and creates drafts.

From: Get Your Hands On Energy

Wind Poems

After watching the wind carry on and hearing its sounds, and after "being" the wind, write a poem about it! The "CINQUAIN" is a simple poetic form that follows this pattern:

one object (in this case, the wind)
two words describing the object
three-word verb phrase
four-word adjective phrase
a synonym of the object or the object

Samples:

Wind
strong and blustery
twisting tree tops
swooshing as it goes
The wind

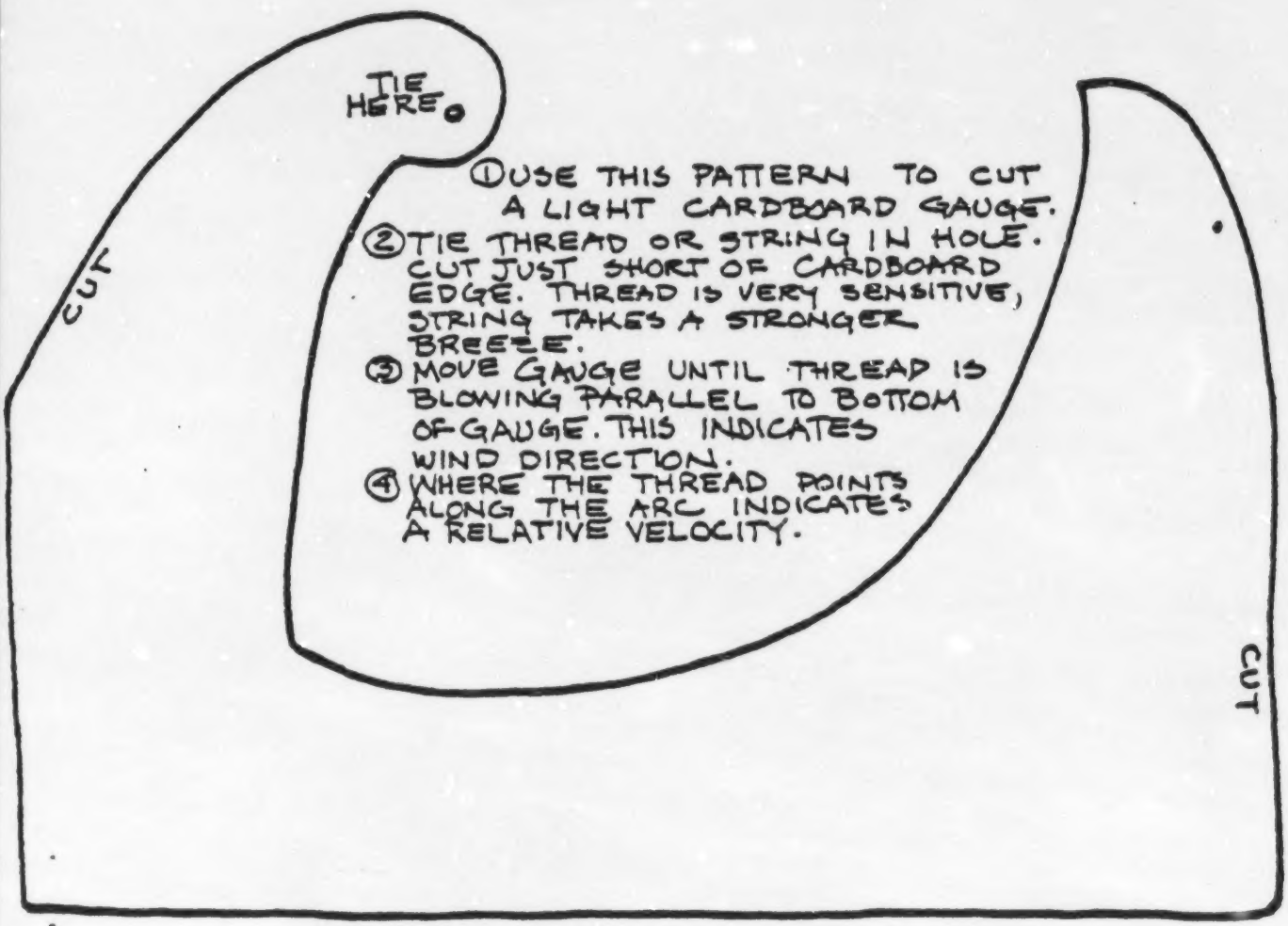
Wind
gentle and good
dancing so lightly
whispering so softly
small sigh

Encourage the children to be descriptive and to think of exciting words and moods about the wind.

Measuring The Wind

Here is a simple wind gauge for use in breezes. It will indicate direction and relative speeds. Use the wind gauge to find out where the wind blows strongest. Compare gauge readings. Do obstacles affect wind speeds and direction?

Edmund Scientific has precision wind gauges of various types.


TIE HERE
CUT
CUT
①USE THIS PATTERN TO CUT A LIGHT CARDBOARD GAUGE.
②TIE THREAD OR STRING IN HOLE. CUT JUST SHORT OF CARDBOARD EDGE. THREAD IS VERY SENSITIVE, STRING TAKES A STRONGER BREEZE.
③MOVE GAUGE UNTIL THREAD IS BLOWING PARALLEL TO BOTTOM OF GAUGE. THIS INDICATES WIND DIRECTION.
④WHERE THE THREAD POINTS ALONG THE ARC INDICATES A RELATIVE VELOCITY.

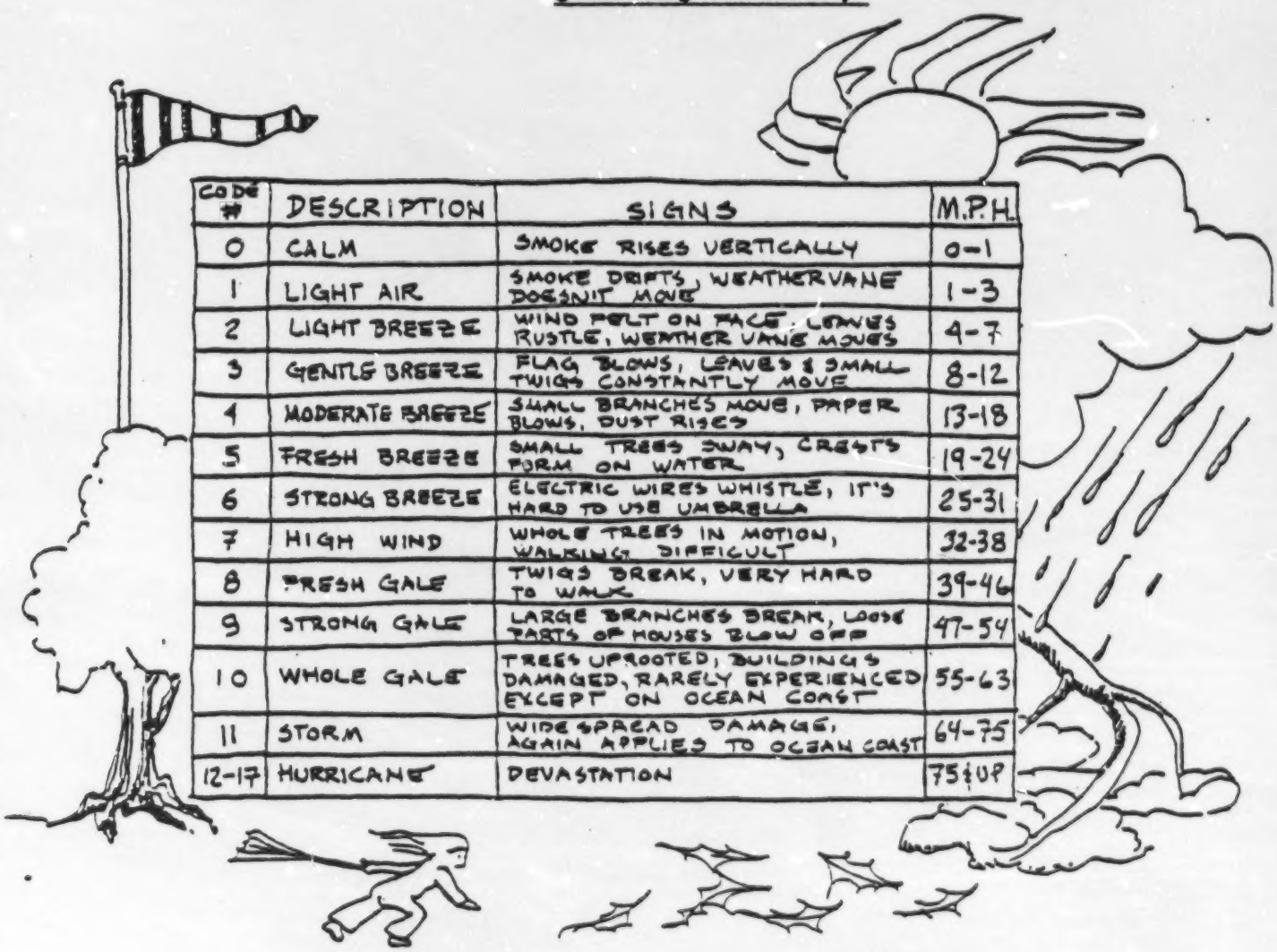
From: Get Your Hands On Energy

Beaufort Wind Scale

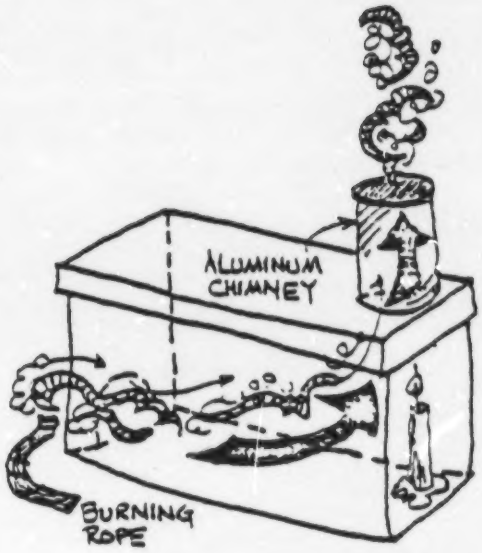
Even without fancy wind measuring equipment, it is possible to determine wind velocity by using a method called the Beaufort Scale. Keep a daily wind chart using this scale; include wind fluctuation throughout the day. This is a good way to sharpen observational skills and to become more aware of the environment 'out there'.

Windspeeds averaging 12 mph are good for electircal generation. Does a windy spot near your school have good potential for generating electircity?

CODE #	DESCRIPTION	SIGNS	M.P.H.
0	CALM	SMOKE RISES VERTICALLY	0-1
1	LIGHT AIR	SMOKE DRIFTS, WEATHERVANE DOESN'T MOVE	1-3
2	LIGHT BREEZE	WIND FELT ON FACE, LEAVES RUSTLE, WEATHER VANE MOVES	4-7
3	GENTLE BREEZE	FLAG BLOWS, LEAVES & SMALL TWIGS CONSTANTLY MOVE	8-12
4	MODERATE BREEZE	SMALL BRANCHES MOVE, PAPER BLOWS, DUST RISES	13-18
5	FRESH BREEZE	SMALL TREES SWAY, CRESTS FORM ON WATER	19-24
6	STRONG BREEZE	ELECTRIC WIRES WHISTLE, IT'S HARD TO USE UMBRELLA	25-31
7	HIGH WIND	WHOLE TREES IN MOTION, WALKING DIFFICULT	32-38
8	FRESH GALE	TWIGS BREAK, VERY HARD TO WALK	39-46
9	STRONG GALE	LARGE BRANCHES BREAK, LOOSE PARTS OF HOUSES BLOW OFF	47-54
10	WHOLE GALE	TREES UPROOTED, BUILDINGS DAMAGED, RARELY EXPERIENCED EXCEPT ON OCEAN COAST	55-63
11	STORM	WIDESPREAD DAMAGE, AGAIN APPLIES TO OCEAN COAST	64-75
12-17	HURRICANE	DEVASTATION	75+UP



From: Get Your Hands On Energy



Draft Box

Drafts in building are desirable for cooling in the summer time.

When you want to cool your house quickly, open a door and window or two windows opposite each other to create a draft.

Demonstrate how rising hot air can be used to create a cross draft with a smoke box. Use a piece of smoldering rope to show air movement. You can also see how fireplaces in a leaky house can actually suck away more heat than they contribute.

IX. EXPERIMENT WITH WATER TO PRODUCE ENERGY

* Moving Water - Moving Blades

You can make a small water turbine model by taping cardboard strips on a cork. Put pins in the ends for axles and make a U-shaped holder for it. You can also slip metal or plastic fins into the slits made in the cork. This will turn as fast as the water stream is moving, so generally turbines have high speed jets directed towards them.

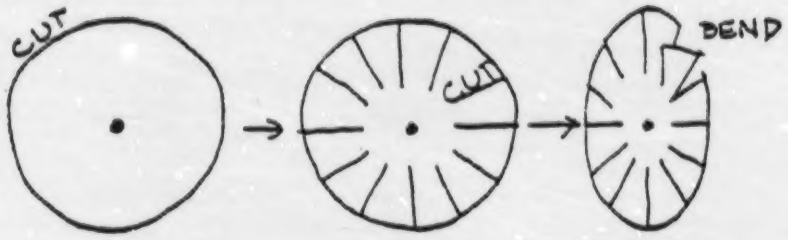
* An Overshot Waterwheel

This model is like the old waterwheels use for grinding grain or running machines. Great power and slow speed were needed to turn the heavy grinding stones at an even speed. This device could use a relatively small stream. It is the weight of the water in the buckets that causes the wheel to overbalance and turn. You can equip your wheel with a string and bucket and find out how much weight the mechanism can lift.

* An Evaporative Cooler

This cooler can be used to keep butter and cheese in very hot, dry weather. Make a thick cotton or burlap bag which will fit tightly over a tin can with a plastic lid. To keep this bag saturated with water, place another can on top which has tiny holes punched in the bottom. You will have to experiment to find the right size and number of holes which will keep the bag wet. Place the butter inside the bottom can and try placing it in the wind, in the sun or in the shade.

From: Get Your Hands On Energy



* A Powerplant From A Juice Can

Since heat is on a microscopic level, just motion of molecules, it makes sense that the motion could be transformed to do work for us. By making a boiler out of a metal juice can, we produce steam which will turn a turbine.

1) Make two holes in a 16-oz. juice can and drain and save the juice. Rinse.

2) Take the lid from another can and cut small slits along the edge with tinsnips. Twist each tab in the same direction to from a propeller.

3) Put a hole in the center of the propeller to form an axis. Make a mount out of a scrap of metal so that the blade may spin freely on a finishing nail. Mount this to the top of the can with duct tape or epoxy glue.

4) The blade should be directly over one of the holes in the boiler. The other hole should be plugged with a screw or stick after the boiler is 1/3 filled with water.

5) You may heat the boiler with a fresnel lens or a large focusing collector (see TOO HOT TO TOUCH) or use a sterno stove. Avoid touching steam and hot objects; they can burn easily.

These projects should be made by an adult or older students. The completed projects are valuable teaching tools for primary students.

From: Get Your Hands On Energy

REFERENCES

1. "Get Your Hands on Energy," Teacher's Guide about Renewable Energy, New Western Energy Show, Helena, MT. (Out of Print)

2. Miles, Betty, Save the Earth! An Ecology Handbook For Kids, Alfred A. Knopf, Inc., New York, NY, 1974.

3. Ross, Michael E., What Makes Everything Go? Yosemite Natural History Association, P.O. Box 545, Yosemite National Park 95389, 1979. (Cost: $3.63 includes postage)

4. "Science Activities in Energy 1980," Teacher/Student Activity packets, Department of Energy, Technical Information Center, P.O. Box 62, Oak Ridge, TN 37830, or Pacific Gas and Electric. (Cost: Free)

5. Teacher's Manual & Student Materials, Connections, National Center for Appropriate Technology (NCAT), Box 3838, Butte, MO 59702. (Cost: $6.00)

6. "Trash Monster Environmental Education Program," Curriculum Set, California State Department of Education, P.O. Box 271, Sacramento, CA 95802, 1980. (Cost: $23.00 per set, $18 for replacement kit)

Some of the activities described in this manual are listed in the Animated Bibliography: A Sampler of Energy Education Curriculum Materials available from the California Energy Extension Service, 1400 Tenth Street, Sacramento, CA 95814.